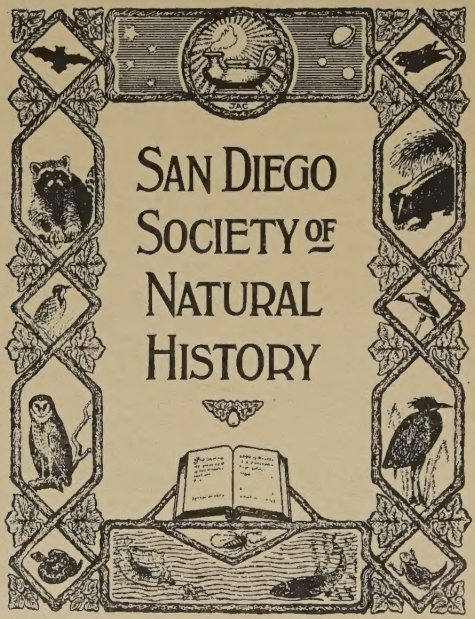
PRACTICAL HINTS TO SCIENTIFIC TRAVELLERS

EDITED BY

H. A. BROUWER

VOLUME IV

B79
B8


SAN DIEGO
SOCIETY OF
NATURAL
HISTORY

SAN DIEGO SOCIETY OF NATURAL HISTORY
B 79
B 8

RICHARD I. JOHNSON

PRACTICAL HINTS TO SCIENTIFIC TRAVELLERS

IV

All rights reserved

Printed in Holland

PRACTICAL HINTS TO SCIENTIFIC TRAVELLERS

EDITED BY

H. A. BROUWER

PROFESSOR OF GEOLOGY, DELFT

IV

WITH 21 ILLUSTRATIONS

THE HAGUE
MARTINUS NIJHOFF
1926

CONTENTS

Preface vii
Egypt, by O. H. Little 1
Angola, by F. J. Faber 49
Australia, by Griffith Taylor, R. Lockhart Jack, H. Basedow, R. H. Cambage and Marjorie J. Shiels 73
Antarctica, by Griffith Taylor 111
Venezuela, by E. A. L. Gevaerts 143
Haiti, by W. P. Woodring 157

PREFACE

The principal object of this book is to compile the experiences of scientific explorers in different countries, so that these experiences are easily accessible. It is not the intention to compete with the existing manuals which have in view to furnish the traveller with a compendium of scientific learning.

Many travellers, although well equipped with regard to scientific work, are only poorly informed as to the things of everyday life as well as to the customs and manners which prevail among white and colored peoples in distant regions. Yet this knowledge is hardly less necessary for the success of a journey.

Personal qualities and personal tastes play an important part in the treatment of some of the subjects. The attentive reader will encounter no difficulties in selecting these subjects, and he may follow the advice or not.

Delft (Holland), July, 1926.

H. A. Brouwer

NOTES ON TRAVEL IN THE EGYPTIAN DESERTS

BY

O. H. LITTLE. M. A., A. R. C. SC. T., F. G. S.
Sub-Director, Geological Survey of Egypt

NOTES ON TRAVEL IN THE EGYPTIAN DESERTS

BY

O. H. LITTLE

CONTENTS

		Page
I.	Introduction	4
II.	List of Institutions, societies and government departments	5
III.	Geographical Features	13
	Position, extent and population	13
	Western or Lybian Desert	14
	Eastern or Arabian Desert	16
	The Peninsula of Sinai	18
	The Red Sea Islands	77
	Climate	19
IV.	Equipment	22
	Personal equipment	22
	Scientific equipment	23
	Tents	24
	Camp furniture	25
	Kitchen equipment	26
	Lighting	26
	Food	28
	Water	29

Page

V. Transport 32
Railways 32
Motor transport 33
Water transport 33
Motor transport in the desert 34
Camel transport in the desert 36
VI. Camping 41
VII. Miscellaneous information 43
Government holidays 43
Bank holidays 44
Currency 44
Customs regulations 45
Medical hints 46
Servants. 47
Shooting regulations 48

I. INTRODUCTION

Egypt, on account of its popularity as a winter resort and its marvellous archeological treasures, has been the subject of many guide books which deal principally with the Nile Valley and Delta.

These notes are intended for those who wish to leave the beaten track and they contain information of interest to the scientific explorer.

The traveller, undoubtedly, will be able to find a certain amount of information about Egypt in his own country but some guidance as to where, in Egypt itself, he can obtain information and advice on his special subject, may prove useulf.

II. LIST OF INSTITUTIONS, SOCIETIES AND GOVERNMENT DEPARTMENTS FROM WHICH DETAILED INFORMATION ON SPECIAL SUBJECTS MAY BE OBTAINED. MOST OF THESE POSSESS LIBRARIES IN WHICH BOOKS MAY BE CONSULTED.

ROYAL GEOGRAPHICAL SOCIETY

Public Works Ministry Gardens, Cairo.

Publishes memoirs and bulletins.

The Ethnological Museum is open to visitors every day from 9 a.m. to noon with the exception of holidays and during the summer.

INSTITUT D'EGYPTE

1 Sharia El Sheikh Rihan, Cairo.

The entrance to the building is in the Public Works Ministry Gardens.

Papers are read before the *Institut* on literary, artistic and scientific subjects concerning Egypt and the neighbouring countries. The proceedings are published in an annual bulletin.

The library contains more than 25.000 volumes and is open every day, except on Sundays and holidays, from 8 a.m. to 1 p.m. For permission to consult books in the library, application should be made to the Librarian.

CAIRO SCIENTIFIC SOCIETY

School of Medicine, Sharia Qasr el 'Aini.

Publication — "The Cairo Scientific Journal".

INSTITUT FRANÇAIS D'ARCHÉOLOGIE ORIENTALE DU CAIRE

37 Sharia el Munîra.
Publishes memoirs and bulletins.

SOCIÉTÉ ROYALE ENTOMOLOGIQUE D'ÉGYPTE

P. O. Box 430, Cairo.
Meetings are held at the Institut d'Egypte.
Publishes memoirs and Bulletins.

SOCIÉTÉ ROYALE D'ÉCONOMIE POLITIQUE, DE STATISTIQUE ET DE LÉGISLATION

21 Sharia Gami' Sharkas.
Publication: "L'Égypte Contemporaine".

ROYAL AGRICULTURAL SOCIETY

Gezira, Cairo.

SOCIÉTÉ ARCHÉOLOGIQUE D'ALEXANDRIE

Museum, Alexandria.
Publishes bulletins.

INSTITUT ROYAL D'HYDROBIOLOGIE

Chatby, Alexandria.

SOCIÉTÉ D'HISTOIRE NATURELLE

Alexandria.

MINISTRY OF AGRICULTURE

Sharia El Falaki, Cairo.

The Administrative and Statistical Service; the Agronomic Section; the Commercial Section; and the Veterinary Service are at headquarters but the following sections are situated at the addresses given below. The Botanical Laboratory and Experimental Farm, El Gîza; the Chemical Laboratory, Higher School of Agriculture, El Gîza; the Cotton Research Board Laboratories, El Gîza; the Entomological Section, Savoy Buildings, Sharia Soliman Pasha; and the Horticultural Section, El Gîza.

The Ministry also controls the Agricultural College, the School of Veterinary Medicine and Agricultural education in the provinces.

MINISTRY OF COMMUNICATIONS

Public Works Ministry Gardens, Cairo.

Departments:

Railways, Telegraphs and Telephones; Post Office; Ports, Lighthouses and Harbour Works; Main Roads and Bridges; Mechanical Transport; and Inland Navigation.

The Roads and Bridges Department maintains the roads between the principal towns.

There are about 2500 kilometres of main roads in Lower Egypt and 1500 kilometres in Upper Egypt. Most of these are mud roads which are kept in repair by filling up holes and flooding half the width of the road in sections.

They carry a considerable amount of motor traffic but in the Delta during the winter they are sometimes impassable for days after heavy rain.

Post and Telegraph Offices have been established at the following places in the desert. The postal service is usually one mail per week and includes ordinary and registered correspondence and ordinary and registered parcels.

Eastern Desert

Hurghada — Post and Telegraph Office.

Jemsa — Post and Telegraph Office.

Safaga — Post and Telegraph Office. Weight of parcels is limited to 3 kilos.

Quseir — Post and Telegraph Office. Weight of parcels is limited to 3 kilos.

Western Desert

Kharga — Post and Telegraph Office.

Mersa Matruh — Post and Telegraph Office.

Sollum — Post and Telegraph Office.

Siwa — Post and Telegraph Office. Weight of parcels is limited to 3 kilos.

Sinai.

El Arish — Post and Telegraph Office.

Abu Zenima — Post and Telegraph Office.

Tor (or Gebel el Tor) — Post and Telegraph Office.

Nekhl — Telegraph Office.

MINISTRY OF EDUCATION

Sharia el Turqa el Gharby, El Insha Quarter.

The School of Medicine and Pharmacy: Sharia Qasr el 'Aini.

The Egyptian Library: Midân Bab el Khalq.

In the Library there are over 100.000 volumes, of which about half are in Arabic and the remainder in different European languages.

There is a collection of ancient manuscripts in the Exhibition Room.

Books may be consulted by the public in the reading room, entrance to which is free.

The Library is open daily to the public, except on Mondays and during the hour of prayer on Fridays. October to May: 9 a.m. to 1 p.m. and 4 p.m. to 8 p.m. June to September: 8 a.m. to 1 p.m. and 5 p.m. to 8 p.m.

MINISTRY OF FINANCE

Midan Laz-Oghly, Cairo.

The Government Publications Office, is situated at the Ministry of Finance. All the publications of the Egyptian Government — with the exception of those of the Ministries of Education and of War — may be purchased at the Government Publications Office or may be obtained through any bookseller, but maps are hold at the Survey of Egypt, El Gîza.

London Agents.

Bureau of Commerce and Industry: Sharia Qasr el Nil, Cairo.

Coastguards and Fisheries: Savoy Buildings, Sharia Soliman Pasha, Cairo.

Headquarters: Alexandria.

Department of mines and Quarries: Sharia Falaki. This Department is the licensing authority for all prospecting, mining and quarrying.

Statistical Department: Savoy House, Sharia Soliman Pasha, Cairo.

Survey of Egypt: El Gîza, opposite the Giza Mudîrîya.

The offices of the following sections are at headquarters:

The Administrative Services, Topographical Survey, Computation Office, Reproduction Office, Map Store and Map Sale Room, Central Stores and Survey School. The offices of the Cadastral Survey, Land Demarcation Office, Geological Survey and Desert Survey are in Cairo.

Map Sale Room — Maps may be purchased at the Map Sale Room, El Gîza and at 31 Boulevard Ramleh, Alexandria where lists of the Cadastral, Topographical, Geological and other maps on sale can be consulted. The most up to date map of the desert regions is the 1 : 500.000, published in 16 sheets at 10 P.T. per sheet mounted on paper, and 15 P.T. per sheet on cloth. The publications of the Survey of Egypt are sold at the Government Publications Office, Ministry of Finance.

Geological Survey and Museum: The offices of the Geological Survey are in the Geological Museum which is situated in the Public Works Ministry Gardens. The Museum contains a comprehensive exhibit of Egyptian rocks, minerals and fossils (including the large fossil mammals from the Faiyum). Specimens of rocks and minerals of economic importance are also on view.

Desert Survey Office, 23 Sharia el Falaki: This section undertakes the exploration and topographical mapping of the uncultivated portions of the country and supplies information on all matters connected with the geography of the desert regions.

MINISTRY OF PUBLIC WORKS

Public Works Ministry Gardens, Sharia Qasr el 'Aini, Cairo.

Antiquities Department: The Egyptian Museum is situated in Sharia Mariette Pasha, at Qasr el Nil and is open daily, except on Mondays and Government holidays, as follows:

March, April and November 9 a.m., to 4.30 p.m. January, February and December 9 a.m., to 4 p.m. May 1st to October 31st 8.30 a.m., to 1 p.m.; on Fridays from 8.30 a.m. to 11.15 a.m.

The entrance fee is 5 P.T. in winter and 1 P.T. in summer. (May 1st to October 31st). Tickets, available for one year (from 1st July), which entitle the holder to visit all the monuments in Upper Egypt, are issued: price 120 P. T.

The Minister of Public Works issues permits for the excavation of antiquities, but these are granted only to approved scientific societies.

Antiquities must not be exported without a permit from the Department of Antiquities and in order to obtain this the objects must be sent to the Museum for examination. They are then sealed and permits issued, authorising transport by railway and passage through the customs.

Physical Department: Insha Palace, Sharia Insha. This Department includes the Hydrological Service, the Meteorological Service, the Weights and Measures Service, the Instrument-repairing Workship and Instrument Store, and the Observatory which is situated at Helwan, about eighteen miles from Cairo.

Zoological Service

The Zoological Service is responsible for the zoological survey of Egypt; the maintenance of the Zoological Gardens and Museum at Gîza; and of the Aquarium and Garden at the "Grotto", Gezira; the protection of birds useful to agriculture; and the preservation of game.

Zoological Gardens, Gîza.

Open daily, 9 a.m. to sunset; admission ½ P.T.

Zoological Museum, Gîza.

Open daily, 9 a.m. to sunset; admission 1 P.T.

Grotto and Aquarium, Gezira.

Open daily, 9 a.m. to sunset; admission ½ P. T.

MINISTRY OF WAQFS

Committee for Preservation of Monuments of Arab Art

Tickets, for admission to the Monuments, price 4 P. T. per person for each building, are sold at the Mosque Section, Ministry of Waqfs.

The Arab Museum

Midan Bab el Khalq.

Open, 9 a.m. to 4.30 p.m., November to April;

admission 5 P.T. Open 8 a.m. to 1 p.m., May to October; admission 1 P.T. Closed on Fridays and Government holidays, Cairo.

MINISTRY OF WAR

Frontier Districts Administration

Sharia Falaki, Cairo.

The Frontier Districts Administration is responsible for the administration and the maintenance of public security in the Oases, in the Eastern and Western Deserts and the Sinai Peninsula.

III. GEOGRAPHICAL FEATURES

Egypt is situated between the parallels of 22° and 32° north latitude and the meridians of 24° and 37° east longitude. It is bounded on the north by the Mediterranean Sea, on the south by the 22nd parallel, on the east by Palestine, the Gulf of Aqaba and the Red Sea and on the west by Tripoli. The area (including the Peninsula of Sinai) is approximately 1.000.000 square kilometres of which about 32.000 square kilometres, or less than the one-thirtieth part, can be cultivated, the rest being desert.

The cultivated portion consists of the Nile Valley and Delta, the Province of Faiyum, and the strip bordering the Ismailia Canal, which flows from Cairo through the "Land of Goshen" to Suez and Port Said. The population of Egypt is now (1925) about 13.000.000 persons and of these more than 99 % live

in the cultivated area. The capital, Cairo (population 790.939 according to census of 1917) which is situated at the head of the Delta, is the largest city in Africa.

The desert portion with which we are concerned, may be divided into the Western or Lybian Desert, the Eastern or Arabian Desert, the Peninsula of Sinai, and the Islands of the Gulf of Suez and Red Sea; the population of this immense area being only 80.504, including 32.663 nomadic Beduin.

THE WESTERN OR LYBIAN DESERT

The Western or Lybian Desert extends from the western cliffs of the Nile Valley to the western boundary of Egypt and may be divided roughly into three regions; the littoral belt, the limestone plateau and the sand-dune country. The Western Oases are a series of depressions which have been formed in the surface of the plateau.

The littoral belt is a relatively fertile strip along the Mediterranean Coast with a maximum width of about fifty kilometres and a rainfall of from 4 to 8 inches per annum. The Mariut railway runs along this belt, but trains now run only to Hammam (78 kilometres) though the line formerly extended to El Daba' (162 kilometres).There is one train per day in each direction.

The Limestone plateau. Southwards from the coast, the ground rises gently to the limestone plateau which attains a height of 120 metres above sea-level at a distance of fifty kilometres from the Mediterranean and continues, with undulations, in a series of low terraces or plateaux. Round Bahariya Oasis the pla-

teau is over 250 metres above sea-level and along the escarpment between Dakhla Oasis and Kharga Oasis it is over 500 metres. Immediately to the south of this escarpment the level is between 150 metres and 200 metres, and Nubian Sandstone is the surface rock. The level rises again to the south and south-west and the Nubian Sandstone is broken occasionally by ridges of granite and other crystalline rocks.

The Western Oases have been hollowed out in this plateau and from north-west to south-east the principal oases are Siwa, (population about 4.500) Bahariya (6.500), Farafra (600), Dakhla (17.000), and Kharga, (8.000); the latter is connected by a narrow-gauge railway, 197 kilometres long, with the Nile Valley at Oasis Junction (543 kilometres south of Cairo). There is one train per week in each direction. The other oases can only be reached by camel or motor car.

The Oases owe their existence to springs and artesian wells which tap the water-bearing Nubian sandstone underlying the Western Desert.

The depth of the wells varies from over 120 metres in Kharga and Dakhla to 3 to 6 metres in Bahariya and Siwa. Round the top of some of the deep wells the ground is artificially raised above the level of the surrounding land so that a small pool is formed above ground level and the water from this is led away to irrigate the land. In other cases the water stands a little below ground level. Many of the wells in Kharga, Dakhla and Siwa are warm, the temperature of the water of different wells varying from 27° to 39° C.

The Sand-dune country. The eastern limit of the dune country is approximately a line from the south

of Moghara Oasis passing to the east of Bahariya and Kharga Oases and reaching the Nile about Abu Simbel. Near this line the dunes are isolated but farther west a great part of the country is a veritable sea of sand with lines of dunes, parallel to the direction of the prevailing wind, rising like waves above the level of the intervening spaces and rendering the country almost impassable in an east-west direction. The general direction of the dunes varies from NNW —SSE to N by W — S by E.

The most easterly of the great dunes is the Abu Moharik Dune which extends, practically without a break for 250 kilometres from north of Bahariya to Kharga, and whose width varies from five to twelve kilometres. Larger dunes exist to the west of Siwa, Farafra and Dakhla.

Mining. The Egyptian Salt and Soda Company works the natron or natural soda deposits in Wadi Natrun. The soda is deposited from the water of a series of lakes in the wadi and is utilised in the manufacture of soap. Wadi Natrun is connected by a light railway, 53 kilometres long, with the Egyptian State Railways at Khatatba, 60 kilometres north-west of Cairo.

No other mineral deposits are worked in the Western Desert.

Owing to the entire absence of water over large areas of the Western Desert it is the least known portion of Egypt, the major part being totally unexplored.

Population (including the Oases) about 45.000.

THE EASTERN OR ARABIAN DESERT

The Eastern or Arabian Desert extends from the eastern cliffs of the Nile Valley to the Red Sea and varies in width from 140 to 550 kilometres. Its dominant feature is the chain of mountains, composed of igneous and metamorphic rocks, which borders the Red Sea and Gulf of Suez. The highest peak is Gebel Shaiyib (2181 metres) which is the highest mountain in Egypt proper, and there are many peaks over 1300 metres of which a number are less than twenty kilometres from the coast. Between the eastern foothills and the sea there is a narrow coastal plain, much cut up by the drainage lines (wadis) which slope steeply down to the sea. On the western side the slope is more gradual and low flat ridges of sandstone and limestone form a series of plateaux which terminate in the cliffs of the Nile Valley. These plateaux are much dissected by deep wadis some of which are over 200 kilometres long.

A plateau of Eocene limestone similar to that of the Western Desert extends along the Nile from Qena to Cairo, its width being between 100 and 140 kilometres. This is much cut up by canyonlike wadis and between it and the igneous hills are plateaux of Cretaceous limestone, and plains and small plateaux of Nubian Sandstone.

To the south of Qena the igneous and metamorphic rocks are of much greater extent and come down to the Nile at Aswan. Only a few outliers of the Eocene and Cretaceous limestone plateaux occur and the greater part of the country between the igneous hills and the Nile consists of a plateau of Nubian sand-

stone in which torrents, descending from Red Sea Mountains, have eroded deep ravines. There are large plains amongst the low hills to the east of the Nubian Sandstone country.

Rain is the source of the small supplies of water which occur in a number of localities, in rock-pools, springs and wells.

Mining. The Eastern Desert is much richer in mineral wealth than the Western. Gold, copper, lead, zinc and emeralds have been worked but the lack of water and cost of transport are against successful exploitation. At present the Anglo-Egyptian Oilfields Ltd., are producing oil at Hurghada and Jemsa. Phosphate is being mined by the Egyptian Phosphate Co. at Safaga and by the Societa Egiziana per l'Estrazione ed il Commercio dei Fosfati, at Quseir.

Population, including nomadic Beduin who live for a portion of the year in villages along the edge of the cultivation, about 30.000.

THE PENINSULA OF SINAI

The northern portion of the Peninsula of Sinai is low-lying, and in places covered by sand dunes, but the ground rises gradually from the coast southwards and the limestone plateau of Gebel El Tih which ends in an escarpment, in places over 1600 metres above sea-level. The country to the south of Gebel el Tih consists of rugged mountain ranges, composed of igneous rocks, much cut up by deep wadis, the highest peaks being Gebel Katherina (2.646 metres) and Gebel Um Shomer (2.602 metres).

Wadi Abu Kahali, debouching from the foot-hills of the Red Sea Mountains on the coastal plain.

Camp at Sherm el Na'ga, Red Sea Coast. Low bank protecting tents from strong northerly winds.

Springs and wells are more numerous than in the Eastern Desert and running water occurs in a few places.

Mining. The Sinai Mining Co. is working the deposits of manganese ore at Um Bogma, which is connected by ropeway and railway with the port at Abu Zenima, and the Egyptian Oil Syndicate is producing oil at Abu Durba. Small pieces of turquoise are obtained by the Arabs from the Carboniferous sandstone.

Population about 5.500.

The Islands in the Gulf of Suez and Red Sea are waterless and uninhabited except for the lighthouse keepers on Shadwan and Ashrafi. Peridots have been mined on Zeberged or St. John's Island.

CLIMATE

Egypt is justly celebrated for its delightful climate in winter and this season should be selected for fieldwork, but the traveller embarking on a desert expedition must be prepared for extreme cold during the nights in December, January, and February.

There are regular winter rains along the Mediterranean Coast and, as a result of these, the uncultivated parts of the littoral belt to the west of Alexandria are covered with a mass of beautiful flowers in the spring time. The rainfall at Alexandria amounts to 8 to 10 inches per annum but it decreases to an average of about 1 inch per annum at Cairo though occasionally as much as 2 inches may fall there in the year. In

Upper Egypt rain is rare, but is very heavy when it falls. Some showers fall amongst the mountains of the Eastern Desert almoste very winter but occasionally in the northern portion a winter or two may pass without rain, and at greater intervals there are violent rain storms. In November, 1923, the Eastern Desert was visited by a severe rainstorm, accompanied by incessant thunder and lightning, which though it only lasted about an hour did considerable damage and caused some loss of life. Along the Red Sea Coast the torrents filled wadis, 100 to 200 metres wide, to a depth of 2 to 4 metres and many sheep and a few camels were washed out to sea, while five persons were drowned. The water had all run out to sea four or five hours after the storm burst. The Egyptian State Railway between Luxor and Aswan was washed away in several places and in this district some lives also were lost.

The rainfall in the mountainous portion of Sinai is greater than in the Eastern Desert, and thunderstorms may occur in October, November and March. The higher peaks are occasionally snowclad for a short time in winter and frost occurs occasionally. After the middle of February, though the early mornings are still cool, it often becomes damp and oppressive about 8.30 a. m. and from then until a breeze springs up, sometime between 10 a. m. and noon, is the worst part of the day.

With the exception of the littoral belt the Western Desert is practically a rainless district, the small amount of rain that falls being due to rare local thunderstorms. The climate of the Oases is not as healthful

as that of the desert and where there are pools and marshes, mosquitoes abound and malaria is prevalent. It becomes very warm after the middle of March but the dryness of the air makes the heat bearable, if one is well protected from the sun's rays. The daily range of temperature in Kharga Oasis is between 30° and 40° F. (16° to 22° C.).

The air in the desert is considerably drier than in the Nile Valley and the daily range of temperature is very much greater. The temperature falls so rapidly about sunset that it is very necessary to take precautions against chill. In elevated and exposed positions, such as where the camel tracks cross the watershed in the Red Sea Mountains (R. L. about 500 metres), on portions of the Western Desert plateau, and in many parts of Sinai the temperature sometimes falls below freezing-point in late December and early January and even in March it frequently falls below 5° C. If one bivouacs on the hills, lower temperatures will be experienced, but at lower levels in the more sheltered wadis, it is unusual for frost to occur. Strong winds, generally more or less northerly, blow almost continuously in the desert in winter, and these influence one's personal comfort even more than the actual temperature. Despite the sun the dry wind often makes it appear cool during the day and the nights then are bitterly cold.

The dryness of the desert air makes the finger nails quite brittle and during very dry periods small pieces break off with the slightest concussion; the skin also dries up and is easily broken. Many suffer the inconvenience of the skin peeling off the face every week

or ten days and as this is decidedly painful a plentiful supply of lanoline or cold-cream should be carried.

Dew is often deposited in the desert during the colder nights but it is never so heavy as in the Nile Valley.

In March, April and May the *Khamsin* — a hot, dust-laden wind from the south or south-west — occasionally blows strongly for from two to five days at a time. It carries along sand and an impalpable dust which blots out the sun and the landscape and insinuates itself everywhere. The shade temperature may exceed 45° C. (113° F). These storms are usually preceded by a sharp rise in temperature and when they have passed the air clears and rapidly cools down again. In the mountains these storms sometimes carry no sand or dust.

The best time for field work is between November 1st and May 1st but the maximum daily temperature varies somewhat irregularly as, in addition to the seasonal change, it is affected considerably by the force and direction of the wind, the presence or absence of clouds and the humidity, so that a warm period may be followed by a cold one or *vice versa*. Thus it is sometimes quite pleasant in October and warm for part of November and while hot days may be experienced in March field-work can carried on in comfort until May, though occasionally April provides a week or ten days warmer than any in June.

IV. EQUIPMENT

Personal. A useful kit for trekking consists of a light flannel or khaki drill jacket, shorts, crêpe-rubber-soled shoes, and woollen stockings. With this costume

there is, when walking, a slight risk from snakes and, when riding, from camel ticks but both these drawbacks are negligible compared with its coolness and comfort. However some prefer khaki drill jodpur or riding breeches with putties or leggings.

If much walking or climbing is to be undertaken boots become of the utmost importance as the surface of the ground is rock, either bare or covered with rock debris, sand or gravel all of which are particularly destructive to boots. The amount of loose, weathered rock debris on the slopes causes an excessive amount of slipping which wears away the uppers as well as the soles of the boots. Nailed boots are too dangerous on slopes and one of the best materials for soles is chrome leather, but even a good pair of chrome leather-soled boots will wear out after about three weeks climbing. Crêpe-rubber soles are now being used instead of chrome leather and by many are preferred for their greater comfort. Their wearing qualities are nearly equal to chrome leather.

A pith helmet is advisable in December and January and essential during the other months, and in the warmer months a spine pad and dark glasses are useful; Crookes lenses are excellent. Good field-glasses are essential and a prismatic compass will be useful. Underclothing should be selected to protect against chill as one is liable to sudden changes of temperature. When climbing it is wise to remove one's jacket and have it carried to the top, as no matter how warm it may appear on the hillside there generally is a strong breeze on the top and after the exertion of climbing it is unwise to cool down too rapidly.

Scientific Equipment. Scientific equipment will depend entirely on the object the traveller has in view and will not be considered here. All instruments should be made to withstand heat and dryness and be dustproof. During sandstorms the fine dust insinuates itself through even the best fitting covers.

Tents. The tent most commonly employed for desert work in Egypt is the Officer's Pattern of the Egyptian Army. This is a double-roofed, single-pole, circular tent, diameter about 4 metres (13½ feet) with side walls 1¾ metres (5¾ feet) high. The pole is made in two pieces each 2 metres (6½ feet) long and the top piece is made to keep the outer roof (*shamsia*) 15 cms. (6 ins) above the roof of the tent. Canvas flaps cover the junction of the walls and roof on the inside and there should be flaps on the inside of the bottom of the tent. In stormy weather these are weighted down with sand and this reduces the amount of sand being blown about in the tent. A canvas carpet to fit the tent, which can be laced in one place from the tent pole to the wall is a very useful addition. There should be at least four large pockets on the walls.

Wooden tent pegs are generally provided but a large supply of these must be carried as they frequently break when driven into stony ground. Iron pegs are a great improvement and for these a sledge hammer must be carried, but if both types of pegs are used the Sheikh must be warned that the camelmen are not to drive the wooden pegs with the sledge hammer or the iron pegs with the wooden mallets, otherwise after a very short time there will be neither wooden mallets nor wooden pegs.

This tent stands the storms very well and will accommodate two camp beds, two chairs and a table and yet allow plenty of room for free movement.

It is usual to privide the cook with a kitchen tent, for which purpose a bell-tent of the pattern supplied to the rank and file of the Egyptian Army is very suitable.

These tents are made in Cairo and the approximate cost is:

Officer's tent (Round pattern)	1170 P.T.
Shamsia for officers tent	540 ,,
Private's tent	610 ,,

One camel can carry an officer's tent and a private's tent complete.

Camp Furniture. From December to March the nights may be very cold and a plentiful supply of bedding should be taken. All the bedding should be carried in an army pattern valise which will keep it clean when travelling, particularly if camel transport is used.

A thick mattress stuffed with cotton wool should be made to fit inside the valise, and from four to six blankets will be found necessary. An eider-down quilt instead of two of the blankets can be strongly recommended as it reduces the weight necessary for warmth on a cold night. Pillows, sheets, etc., can be carried according to individual taste.

The camp beds are supplied with poles to take a mosquito net, but though there are no mosquitoes in the desert, except in the oases, the nets are useful to keep off flies, moths, etc., which sometimes occur in thousands.

There is only a very slight risk of snakes or scor-

pions getting into ones, bed, but if a mosquito net is used regularly it practically eliminates this risk.

Other useful articles are: —

Chairs. Roorkee pattern, canvas chairs. These pack into very small space and are very comfortable, but a wooden chair or stool should also be carried.

Table. There are many patterns of folding table but one of the best is that known as the Abyssinian folding table.

Combined folding canvas bath and wash stand.

Leather band with hooks to fix on tent pole.

Kitchen Equipment. Cooking is generally done on the ubiquitous Primus or one of the improved forms of this stove, or on a charcoal stove (*kanoon*). Small ovens are sold for the Primus stove which are very useful and travel well if fitted into a strong wooden box. Paraffin for the stoves is carried in strong drums holding about six gallons and the cook should be made to keep it well away from the food supplies. A portable oil-stove for heating the tent is almost a necessity in December and January. Canteens fitted for two or more persons will provide the cooking utensils, cutlery, enamel plates, etc.; but the cook will probably require a few extra articles such as large knives, and spoons, saucepans, etc., and half a dozen strong glasses and China cups should also be taken. Most of the latter may be broken in a short time but generally a few survive to the end.

Lighting. The Egyptian *Shemadan* — a spring candlestick with globe — is the usual source of light. They

are packed in pairs in wooden or leather cases which also contain two or four spare globes. If paraffin is carried, "Hurricane" lamps are very useful and for reading a small metal lamp with about half a dozen spare globes should be carried. Acetylene is perhaps the best illuminant and lamps are now supplied with pink globes or brass reflectors which decrease the glare. Carbide can be obtained in lever lid tins containing 1 kilo.

An electric torch with spare batteries should also be included in the outfit.

LIST OF PRICES OF SOME ARTICLES OF CAMP EQUIPMENT IN CAIRO (1925)

Bath, canvas	105	P.T.
Bucket canvas	55	,,
Box, travelling, wood	125	,,
Box, travelling, iron	155	,,
Canteen filled for two	275	,,
Canvas carpet for tent	150	,,
Carpenters, tools in leather roll	240	,,
Chair, Roorkee	170	,,
Chair, wooden folding	60	,,
Camp bed	275	,,
Mosquito net for camp bed	95	,,
Candlesticks, pair in leather case	160	,,
Drum for paraffin	85	,,
Fantasses 12½ gals	150	,,
Fantasses 15 gals	250	,,
Primus stove	40	,,
Primus stove oven	100	,,
Lamp, acetylene	20	,,

Carbide 1 kilo	3 P.T.
Medicine chest	275 ,,
Table, Abyssinian	180 ,,
Tent, officer's, round pattern	1170 ,,
Shamsia forab ove	550 ,,
Tent, private's	610 ,,

Food. No supplies of food can be obtained in the desert except at a few mining camps which run canteens for their workers, where permission may be obtained to purchase goods. Very often the articles required are not in stock so these sources should not be relied on. Provisions for the whole journey should be purchased in Cairo where a great variety of tinned and dried goods can be obtained; but if the expedition is to last for several months, arrangements can be made to have portions forwarded, at a later date, to some place along the railway where they can be picked up by camel. Stocks should never be allowed to run low as there is always a danger of the new supply being delayed en route.

It is very difficult to procure fresh meat, fruit, and vegetables in the desert but they can sometimes be obtained by the postman when he goes for letters.

Chickens will thrive on the journey and provide eggs and fresh meat, but care must be taken to ensure that they are perfectly healthy at the start as if not they may all die within a week.

If it is intended that any camps should be near the seashore it should be stipulated that some one (preferably the guide, but failing him the postman or one of the camel men) should be a good fisherman, as very

fine fish can be caught along the edge of the reefs, which provide a welcome change from tinned food. Fish can sometimes be purchased from Arabs camped along the coast but it should be examined to see that it is perfectly fresh.

A certain amount of game may be shot but one cannot depend on this source of supply. It varies very much with the district; in general the Eastern Desert is better than the Western and Sinai best of all.

Bread should be baked regularly and for this, in addition to flour, a small amount of yeast, hops and potatoes are necessary.

Water. There is a striking difference between the water supplies in the Western Desert and those of the Eastern Desert and Sinai. In the Western Desert there are abundant supplies of water, derived from artesian wells in the Oases, but none on the arid desert surrounding them so that when crossing the desert between the Oases and the Nile it is necessary to start with a supply of water sufficient for the whole journey — generally about six days by camel. In the Eastern Desert and Sinai the water supply is dependent on the rainfall and small springs, wells and rock-basins are fairly numerous, so that one is seldom more than a day's march from water, though during a period of drought the distances between supplies may be much greater.

The 1 : 500.000 map published by the Survey of Egypt shows practically all the desert wells, but for actually finding the wells it is wise to depend on the guide. One cannot rely on the camel men, particularly

if the party is small, as many of these spend most of their lives in the Beduin villages along the edge of the cultivation, and have only a poor knowledge of the desert. Springs and rock-pools (*galts*), if they are not dry, are fairly easily located from the map but wells dug in the floor of the wadis are filled up after every rain storm and there may be nothing on the ground to mark their position until the Beduin dig them out again. In order to conserve the water supply the Beduin do not re-open the wells until the springs and rock-basins are exhausted.

The water of many of the springs and rock basins, particularly in sandstone and granite country, is quite fresh but the salinity of the desert wells varies considerably and they become more brackish after a long period without rain.

Small supplies of potable water can sometimes be obtained along the coast by scraping small holes in the beach just above high-water mark. As water is taken from the hole it gradually becomes more brackish, but it is only necessary to scrape a new hole some yards from the original one to obtain a new supply of drinking water.

It is wise to boil the water from desert wells as it is frequently contaminated by the Arabs when watering their camels,donkeys,sheep and goats, and they themselves are not above bathing in the water. Some of the portable filters are efficient but it is difficult to make native servants use them continuously or keep them clean.

On the Red Sea Coast distilled water may be purchased from the Government Condensing Station at

Quseir. The Egyptian Phosphate Co. distil water at Safaga and the Anglo-Egyptian Oil Co. bring Nile water down from Suez to Hurghada and permission may be obtained on application to the Managers of these Companies, to purchase a reasonable amount of water, at fixed rates. If the fantasses are sterilized before being filled with distilled water it may be drunk without being boiled, and if it has to be transported a short distance by camel the jolting will re-aerate the water and make it very pleasant to drink. In districts where the water is brackish it may be necessary to carry bottled water for drinking, and to use the well water for cooking and washing only.

The water is carried in iron tanks (*fantasses*) which are made to hold about 10, 12 or 15 gallons. The Arab will not load more than two full fantasses on a camel, because of the difficulty of balancing a third, therefore, it is advisable to have the largest size. The opening should be closed by a screw-cap, which can be opened only with a special key so that the Arabs will not be able to steal the water.

Before being used the fantasses should be sterilized by allowing a strong solution of potassium permanganate to stand in them for some time. A couple of extra fantasses should be carried empty as on occasions it may take the camels two or more days to bring back supplies of water fit to drink. It is also useful to have a spare fantass in case one may be damaged and leak.

Each member of the party should have at least two aluminium water-bottles, covered with felt. A good canvas water bottle will keep cooler but most of them are either too porous or are almost impermeable, and

washing them out with a solution of potassium permanganate does not sterilize them as effectively as it does the aluminium bottles. A canvas bucket should be carried and if water can be spared, or one is near the sea, it should be filled each night and the tins and bottles which will be required next day should be placed in it to cool.

Vacuum flasks are also very useful.

V. TRANSPORT

Railways. The inhabited portion of Egypt is served by the Egyptian State Railways and the following narrow gauge lines: — The Delta Light Railways, Société Anonyme des Chemins de Fer de la Basse — Egypte and the Faiyum Light Railways. The principal lines of the E. S. R. are from Cairo to Alexandria, Mansura, Port Said, Suez and Luxor with a narrow gauge on to Aswan. Length of line 2574 kilometres.

Restaurant-cars and sleeping-cars run by the *Compagnie des Wagons-lits*, are attached to certain trains. There is no free allowance of baggage but light articles of personal baggage may be transported, free, in the carriage with the traveller. Heavy baggage must be presented for registration at least a quarter of an hour before the departure of the train.

The Delta Light Railways Co., owns about 900 kilometres of line and the Société Anonyme des Chemins de Fer de la Basse-Egypte about 250 kilometres in Lower Egypt. The Faiyum Light Railways Company's system is about 150 kilometres in length and connects the principal villages in Faiyum province with the E. S. R. line at Medinet el Faiyum.

The railway across Sinai from Kantara to Palestine via El Aresh and Rafa is worked by the Palestine Railways and sleeping-cars and restaurant-cars are attached to trains which connect with the Egyptian State Railways at Kantara. The railway bridge which existed across the Suez canal was removed after the conclusion of peace and passengers are now transported across the canal by motor ferry.

Motor transport. Motor cars can be hired in most large towns in the provinces. They can be engaged for 2 P.T. per kilometre plus 5 P.T. per hour for waiting, and though charges vary these figures will provide a basis on which to bargain.

Water Transport. In addition to the regular tourist steamer services on the Nile from Cairo to Luxor and Aswan, some local steamers ply between Cairo and the Delta Barrage and also to Bedrashin (for Sakarra). A considerable amount of goods traffic along the Nile and navigable canals is carried by sailing boats. (*Gyassa*).

DESERT TRAVELLING

Before making arrangements for an expedition into the desert, information as to the district it is proposed to visit, the dates of starting and finishing, etc., should be sent to the Director General, Frontier Districts Administraiton.

The use of motor transport in desert regions is daily extending and along selected routes and

under favourable conditions it has undoubtedly immense advantages over transport by camel, but with the latter one can visit districts inaccessible to motors and for small expeditions it is more reliable and less costly. The Arabs also possess donkeys which regularly go for three or four days without water; and on well watered routes, such as that from Qena to Quseir, a donkey might be used if preferred to a riding camel. The day's journey is limited to what the baggage camels can do and these take five or six days for the journey from Qena to Quseir which motor cars do in one day.

Motor Transport. Motor cars and lorries of many makes are now employed in the desert. In the Eastern Desert there is a motor road from Qena to Quseir (190 kilometres = 119 miles) and this distance is covered regularly in a day, by the cars and lorries of the Italian Phosphate Co. and by lorries which bring fish to Qena and Luxor.

From Luxor parties of tourists have been taken to Quseir by motor.

From Quseir motor cars can travel north along the coast to Safaga (80 kilometres), Hurghada (140 kilometres), Jemsa (220 kilometres) and further if necessary. The desert motor roads or tracks are made simply by clearing the larger stones to either side of the track and smoothing down the worst of the bumps. Cars are not confined to these roads and with a certain amount of bumping and the risk of getting stuck occasionally in soft sand they can travel along most camel-tracks and for miles up many of the big wadis,

in some places being able to travel right up into the mountains.

During the war, motor cars (principally Fords) were extensively employed in the Western Desert and immense distances were covered. The cars were driven in convoys as they very frequently stuck in soft sand and sometimes broke down. If the speed can be maintained the Ford will cross patches of fairly soft sand, but if it is allowed to drop below about 30 kilometres per hour the wheels will break through the surface crust and the car will stick. There is then nothing to do but laboriously to pull it out on to firm ground. Some parts of the limestone plateau are too rough for cars, the terraces can only be gained where there are tracks up the scarps and the sand dunes are impassable. Since the war ended, creeper-track cars (Citroens) have been employed with great success; they have surmounted dunes and they can rescue ordinary wheeled cars should these get stuck in soft sand.

In Sinai there are still the remains of metalled roads made during the war but they have been cut through in many places by torrents. The road from El Arish to Nekhl is kept in repair by the Frontier Districts Administration. As in the Eastern Desert, cars can travel along many of the camel tracks and a certain distance up the big wadis.

Two lengths of wire-netting or expanded-metal, longer and wider than the car, are very useful for extricating it from soft sand. The car is pushed on to one piece, the second piece is then laid in front, the car is pushed on to it and this operation repeated.

Motor bicycles with sidecar attached can be used

whenever it is practicable to take a car, but motor bicycles (without sidecar) and push bicycles are more useful for running about the desert though they should always be used in pairs. The singletrack machines can be ridden along the narrow camel-tracks and though on some of the passes the tracks are steep and rocky they are used by loaded baggage-camels and can nearly always be negotiated. On the open desert the single track also permits one to pick one's way through rough ground, and in soft sand, by dismounting and running beside the machine, it can be taken over ground in which a car would stick. In sand or if the ground has been cut up by motor traffic it may be heavy work pushing an ordinary bicycle but along the normal camel-track it is possible to travel faster on it than on a hagyn (niding camel).

Camel Transport. While in Cairo a visit should be paid to the Frontier Districts Administration, in order to learn the name of the Sheikh of the Beduin tribe from whom camels must be hired, current rates for hiring camels, etc. If the expedition is to start from a Mudiriya town, the Governor (Mudir) of the Province should be called on and he may be able to supply much other useful information.

The charges for camels and personnel for a desert expedition were raised gradually during the war and at the conclusion of peace they had reached nearly double the pre-war figure. Since then they have been reduced, but are still much higher than formerly, and the prices now (1925) vary, according to the district, between the following limits:

Sheikh in charge (including his camel)	20 to 40	P.T.	per	day	
Mounted guide (including his camel)	20 ,, 35	,,	,,	,,	
Postman (including his camel)	20 ,, 30	,,	,,	,,	
Porter (skilled)	14	,,	,,	,,	
Porter (unskilled)	10	,,	,,	,,	
Riding camel	16 ,, 20	,,	,,	,,	
Baggage camel (including one man to each two camels)	12 ,, 15	,,	,,	,,	

In northern Sinai, if one only requires to travel along the more frequented routes, camels can often be obtained from the El Arish tribes at much lower rates. One contract was made at as low as six piastres per camel, per day, but there was only one man to four camels.

Camels are hired through the Sheikh of the tribe in whose territory it is proposed to travel who may delegate this duty to a contractor. It is usual to draw up a written contract stipulating that pay will begin from the day on which the expedition starts. Even then the camels may not be ready until a day or two after the date fixed for the start. They always like to wait until the weekly market to purchase supplies for the journey and for this purpose the contractor will ask for pay in advance. About half a month's pay is sufficient, which is deducted from the account at the end of the first month.

The Sheikh in charge (*Sheikh Hamla*) often belongs to the family of the head Sheikh. He represents the contractor and is responsible for the carrying out of all orders and the good conduct of the guides, camel-

men and porters. He should have a good knowledge of all the desert routes as he may have to move the camp from one locality to another without the assistance of the guide. The contractor may authorise him to receive the pay for the whole party at the end of each month or may prefer to be paid by cheque and fix the amount to be advanced to the Sheikh Hamla each month.

The guide who is selected, primarily, for his knowledge of the district to be visited, is the most important Arab in the party and particular care should be taken to choose a capable man.

If a postman is engaged he should be capable of taking the place of the guide should anything happen to the latter and, in any case, must have a knowledge of the country as the camp will probably be moved a considerable distance while he is away for the post, which might take him anything from one to sixteen days.

Porters will only be required if heavy instruments, etc., have frequently to be carried for some distance away from the camel tracks. If the instruments are only required along the route a camel can be detached from the caravan to carry them.

The guides, postmen, porters and camel drivers all assist in pitching tents, collecting firewood (if available), loading camels, filling fantasses etc.

The price of the riding camel (hagyn) includes a saddle and a man or boy to look after it.

The saddle should be examined and rejected if not comfortable alike for the rider and the animal. The hagyn should be ridden for a long distance before

being accepted, as one will be very comfortable on a good hagyn but will experience extreme discomfort on the bad animals frequently supplied.

The average rate of a trotting camel is eight kilometres (five miles) per hour and they can easily cover fifty kilometres per day and for short periods a good hagyn can maintain eighty kilometres per day.

The contractor pays the camel drivers and supplies water skins for all his men. He also provides food and water for the men and camels. The camel food should be carried by the contractor at his own expense, that is, he should not be paid for camels loaded exclusively with camel-food but in practice each camel will carry its own food also the food and water of its driver. In the Eastern Desert and Sinai the camels graze as they march along the wadis and are turned out after they arrive at the camping ground.

Their rate of march is wonderfully regular being four kilometres ($2\frac{1}{2}$ miles) per hour and distances are usually reckoned by the time that baggage camels take to traverse them. Camels can march ten hours per day for long periods. For shorter periods this can be increased to twelve hours per day with a halt of a couple of hours at midday. In very hot weather, if the work permits, it is better to march by night when there is sufficient light from the moon, but when there is not, start before sunrise, rest from about noon to 4 p.m. or 5 p.m., then continue until dark. It will be unnecessary to pitch a tent for the night and, except in the Western Desert the midday rest can generally be spent in the shade of a rock. The guide will know every place along the line of march where shade can be

found at midday, and as these are often far apart they should be considered when arranging the itinerary. The riding camels can travel about twice as fast as the baggage camels so that one can spend several hours at work along the route, then ride ahead and reach about noon a shade which the baggage camels will not pass until after their midday halt.

In addition to their own baggage one can reckon on each camel carrying three qantars (about 300 lbs.) and a good camel may take four qantars, but this is exceptional.

The number of camels required depends not only on the number of persons in the party and the weight of their equipment but will also depend on the length of time for which provisions are being carried and the maximum number of days march between the water sources along the route. On the latter condition depends the number of camels necessary to carry water.

If the total weight of the baggage in pounds be divided by 300 the resulting figure will be, approximately, the number of camels required, to which must be added one camel for every two full fantasses of water. One camel should be lightly loaded so that the cook can ride it. If he has to walk all day he will arrive at camp too tired to perform his duties efficiently. A single person, travelling light, might manage in the Eastern Desert, with only six or seven camels. In this case a sheikh and postman could be dispensed with and one individual would combine the office of sheikh and guide.

Camels must be watered every five to eight days

according to the weather and while the camp should not be pitched in the immediate vicinity of a well it should be as close to a well as convenient when the camels need to drink. Each camel will drink ten gallons of water and should the supply be small it may take half a day or more to water twenty camels.

VI. CAMPING

In the Eastern Desert and Sinai the camel-tracks generally follow the main wadis and the camp should always be so placed that it will not be washed away should a torrent (*seil*) suddenly come down the wadi. The site should be selected so that there is shelter from the prevailing wind and the ground capable of holding the tent-pegs. A low bank (about five metres high) running perpendicularly to the direction of the wind will give better protection then a high cliff, as there will be fewer eddies behind it.

In the big wadis the camp should not be pitched near patches of vegetation. The green plants no doubt offer a pleasing contrast to the desert during the day time, but they are liable to harbour moths, flies, beetles, etc., which will be attracted in numbers by the lights in the tents at night. Sand flies sometimes occur amongst bushes along the coast and also near pools of water, whether sweet or brackish. In such localities the camp should be placed about half a kilometre up wind from the vegetation.

A supply of sand-bags is very useful as when the ground is not good these can be filled and one placed on each tent rope, just in front of the peg. If sand-

bags are not available the Arabs will place fantasses, boxes, etc., on the ropes and failing a sufficient supply of these will resort to heavy stones. The latter will cut the tent ropes in a very short time and must not be allowed. It is unnecessary to use the *shamsia* when moving camp daily but the tent will become too hot without it in the daytime, except during the months of December and January. The Sheikh should be instructed to place the tent-pegs for the *shamsia* sufficiently far outside the pegs for the roof to maintain a good air space between the roof and the *shamsia*.

The additional ropes on the *shamsia* help to hold up the tent in a strong wind. In cold and windy weather sand or gravel should be piled up round the sides of the tent to exclude the wind and even than a small portable stove will be found very pleasant.

In cold weather the site should be selected so as to get the benefit of the early morning sun and in hot weather one can often obtain protection from the sun's rays either in the morning or afternoon by camping in the shade of a hill.

All loose stones should be cleared from the tent as they harbour scorpions. Make it a rule never to pick up a stone by placing the fingers underneath it, as if it is lifted in this manner there is a danger of being stung by a scorpion.

The kitchen tent should be to leeward of the tents and the camel-men should be made to camp some hundreds of yards further down wind. They collect dry twigs on the march each day for cooking their food at night and if they have sufficient firewood they often keep the fire burning until midnight. They sit round

it singing or telling stories and the noise they make will become very disturbing if they have not been made to camp far enough away.

VII. MISCELLANEOUS INFORMATION

GOVERNMENT HOLIDAYS

The following are celebrated according to the Gregorian Calender:

The Birthday of H. M. King Fuad., 26 March.

The Accession Day of H. M. King Fuad., 9 October.

Independence Day (Egypt) and Inauguration of the Egyptian Parliament. } 15 March.

The following movable feasts are celebrated at the same seasons of the solar year:

Sham el Nessim is the Coptic Eastern Monday. Occurs in April or May. 20th April, 1925.

The Cutting of the Khalig. This celebrates the rising of the Nile and is fixed by the Council of Ministers, usually in the latter part of August.

The following feasts are celebrated according to the Mohammedan Calender:

New Year's Day 1 Moharram 22 July, 1925.
Mulid el Nabi 12 Rabi' el Awal 30 Sep., 1925.
Ramadan Bairam, Last day of Ramadan and first three days of Shauwal 23 April 1925, 24-26 April 1925.
Qurban Bairam 9-14 Zu el Hegga 30 June to 4 July 1925.

The exact dates of the following are fixed by the Council of Ministers:

The Ceremony of the Holy Carpet } first half of Zu el Qâda. first half of June 1925.

The Departure of the Mahmal	Second half of Zu el Qâda. Second half of June 1925.
The Return of the Holy Carpet and the Mahmal	Second half of Moharram.

BANK HOLIDAYS

New Year's Day, New Style	Easter Monday.
New Year's Day, Old Style	Easter Monday (Eastern Church). Falls on the same day as Sham el Nessim.
Birthday of H.M. King Fuad	Whit Monday.
Accession of H.M. King Fuad	Whit Monday. (Eastern Church).
Ramadan Bairam (First Day)	Day of Atonement (Kippur).
Qurban Bairam (First Day)	Christmas Day.
Good Friday	Christmas Day. (Eastern Church).

Good Friday (Eastern Church).

Office hours: 8.30 a.m. to 12.30 p.m. from 1 May to 1 October.

9 a.m. to 12 noon and 3 p.m. to 4 p.m. in winter.

Most of the Government Offices close on Fridays and the banks close on Sundays.

CURRENCY

The Egyptian pound is divided into 100 piastres or 1000 milliemes. The National Bank of Egypt issues notes in denomination of L.E. 100, L.E. 50, L.E. 10, L.E. 5 and L.E. 1, which are legal tender.

The British sovereign is also legal tender at the rate of 97½ piastres.

Coinage

		£ s d
Gold 1 pound	= 100 P.T.	= 1. 0. 6. 1.
" ½ "	= 50 P.T.	= 10. 3.
Silver 20 piastres		= 4. 1. 2.
" 10 "		= 2. 0. 6.
" 5 "	= approximately	= 1. 0.
Nickel 10 milliemes	= 1 piastre	= 2½
5 "	= ½ "	= 1¼
2 "		
1 "		

CUSTOMS REGULATIONS

All goods imported into, or exported from, Egypt must pay custom duties. The dues are collected at the port at which the goods enter or leave the country but arrangements can be made to send goods to Cairo in bond and pass them through the Customs there. It is advisable that the traveller should be present at the examination of the baggage.

The import duty is eight per cent *ad valorem* on most articles but there are special duties for alcoholic liquors, tobacco, etc. In addition there are quay dues, municipality dues and paving dues which vary at the different ports but generally amount to between a half and one per cent.

The export duty is one per cent *ad valorem* on all products of Egypt and the Sudan and quay dues, etc., are also levied.

No export duty is charged on foreign goods re-exported, and, provided that arrangements are made with the customs authorities at the port of entry, a refund of the difference between the import and export duty is made in the case of certain goods re-exported.

MEDICAL HINTS

It is essential to be re-vaccinated and also inoculated against typhoid before starting for Egypt, but in the desert the air is pure and practically sterile. In some of the Oases of the Western Desert and at most of the mining camps in the Eastern Desert and Sinai there is a resident doctor who could be consulted in case of serious illness but for desert travelling a small medicine chest, containing the following is recommended:

Aspirin; boric acid; calomel; cascara sagrada; chlorodyne; corrosive sublimate; dovers powders; easton syrup; iodine; lysol; oil of cloves; carbolic ointment; cold cream; lanoline; phenacetin; potassium permanganate; quinine; zinc ointment; zinc sulphate; yellow ointment (*Ung. Hyd. Ox. Flav.*); anti-scorpion serum; antivenom serum; bandages; cotton wool; lint; basin graduated in ozs.; caustic pencil; clinical thermometer; eye-bath; forceps; gauze; lancet; safety pins; surgical scissors; glass syringe and hypodermic syringe.

Large quantities of epsom salts and castor oil will be found very useful for treating the Arabs.

The anti-scorpion and anti-venom serums should

be quite fresh. The horned viper (*Cerastes Cornutus*) which is met with occasionally is the only snake that the Arabs dread and it is said to be deadly.

SERVANTS

It is important to secure servants who have had experience of desert travelling as the average valley dweller dreads the desert. Berberine servants are the most satisfactory and one can nearly always be found who can speak a little English or French, or both. Arabic is not an easy language to learn but sufficient to give orders to servants can be picked up quite quickly, and it is surprising how much they understand even if one has only a small vocabulary composed of nouns, adjectives and the imperative mood of verbs. There are a number of useful phrase books and small grammars on the market.

The wages of servants are now from L.E. $3\frac{1}{2}$ to L.E. 5 per month. They provide their own food but expect to receive an allowance of tea and sugar. As most of the food will be tinned it might be thought that there is not much scope for a cook to display his ability but there is a great difference in the ways in which tinned foods can be cooked and a cook who has had experience of desert life can often do quite well. He must be able to make good bread and know how to keep the yeast in sound condition as biscuits and the scones and soda bread that they prefer to make soon become monotonous. It is essential to insist on this point as bread-making being a woman's occupation in the villages it is not one of the normal accomplishments of a Berberine cook.

If the cook has not had previous experience the process of making yeast bread is so simple that a few lessons from one of his confrères will generally enable him to carry on.

One's requirements in the desert are so few that in addition to his culinary duties the cook can render all the personal service necessary and he always superintends the laying out of the camp and arranges the furniture, etc., in the tents.

SHOOTING REGULATIONS

The fauna of the desert is not extensive but gazelle, ibex, desert-hare, sand-grouse, partridge, quail, etc., are occasionally met with. Some of the animals and birds are protected in certain districts and information as to the regulations existing in any part of Egypt may be obtained on application to the Director, Zoological Service, Giza, near Cairo.

To import sporting arms and ammunition into Egypt a permit from the Director of Ordnance, Citadel, Cairo is necessary. This can be obtained before arriving in the country, but if arms are brought to Egypt without this authorization they will be held up at the Customs until it has been obtained. There are several shops in Cairo where shot-guns and ammunition can be purchased. A licence to shoot (*permis de chasse*) costs P.T. 100 and is available throughout Egypt for one year from June 1st.

NOTES ON TRAVELLING IN ANGOLA (AFRICA)

BY

F. J. FABER M. E.
Geologist, Technical University, Delft

NOTES ON TRAVELLING IN ANGOLA (AFRICA)

BY

F. J. FABER

CONTENTS

1. Preparatory matter 51
2. Literature and maps 52
3. Official 54
4. Population 56
5. Languages 57
6. Articles of barter 58
7. Climate and travelling season 59
8. Food and drink 60
9. Equipment 62
10. Transport 64
11. Campsites 70
12. Health 71

1. PREPARATORY MATTER

Societies and institutions, willing or able to give information about scientific exploration in Angola are:

In Portugal:

Sociedade de Geografia de Lisboa. (Rua Eugenio do Santos). They publish the "Boletim da S. d. G."

Agência Geral das Colónias (Rua da Prata 34, Lis-

boa). (Monthly is published the "Boletim da Agência, etc., under the auspices of the Portuguese Colonial Office in Lisbon, with English and French summaries).

Museu Comercial, Lisboa.

In Angola:

Serviço de Minas da Provincia de Angola.

Serviço Meteorologio da Pr. de Angola.

Gremio de Estudos Zaire.

2. LITERATURE AND MAPS

The two most important periodicals are already mentioned in § 1.

Some important books on Angola, with many references to the literature are:

BORCHARDT, PAUL. Bibliographie de l'Angola 1500—1910. Monographies bibliographies II. Instituts Solvay, Bruxelles.

MARQUARDSEN, Dr. HUGO. Angola. Berlin, 1920. With detailed and critical literature, and a very good map, 1 : 2.000.000.

Some books of travel, which have recently appeared, are:

STATHAM, Colonel J. C. B. Through Angola, a coming Colony. Edinburg and London, 1922.

STATHAM, Colonel J. C. B. With my Wife across Africa. London, 1924.

BEBIANO, JOSÉ BACELLAR. Geologica e riqueza mineira de Angola. Lisboa, 1923.

SCHACHTZABEL, Dr. ALFRED. Im Hochland von Angola. Studienreise durch den Süden Portugiesisch West-Afrikas. Dresden, 1923.

Concerning Practical Hints there is much to be found in the essay of PERCY A WAGNER, and TUDOR G. TREVOR, Notes on Travel in South- and East-Africa. This series of Practical Hints I. 2d ed., The Hague, 1925.

Also much is to be found in the Handbook of Travel of the Harvard Travellers Club (Cambridge, 1917) and in Hints to Travellers by the Royal Geogr. Soc. (London, 1921).

Maps and charts of Angola or regions of it are always very rough and not good for practical use. Many sketches are scattered in various books on Angola. The prin-cipal Portuguese maps are:

Esboço da Carta de Angola, 1 : 2.000.000, 1912.

About 1920 a new Portuguese military map was published, with the principal roads, the districts and the residences of civil and military functionaries. The data are only approximate.

The southern rivers (Kunene) are exceptionally well known; they are described by the former Governor João d'Almeida, in a book entitled "Sul d'Angola".

It is said that several parts of Angola are being surveyed topographically. Recently the "Min. das Colonias, Commisau de Cartografie" has published some charts or maps, 1 : 20.000: Reconhecimento hidrografico da Baia de Benguella Velha (Porto do Amboim) Baia de Diogo Cão (Rio Zaire), Baia das Solinos, Porto de Ambriz and some others.

By far the best map is that published in the book by Marquardsen, prepared by Sprigade, Moisel and others, 1 : 2.000.000, and sold also separately (edited by the "Reichs-Kolonial-Amt", Germany).

But many of the indicated roads are not to be found, and many of the villages do not now exist: the natives have the custom of moving often; sometimes the indicated villages are only little plantations with a negro as manager, while other much bigger plantations and some good roads are not indicated. But on the whole, it is the best map of the colony and usable for many purposes.

Another map is edited by the „Société Internationale Forestière et Minière du Congo," and the „Soc. Roy. de Géographie de Bruxelles." „Congo Belge et Angola" Ed. 1926, Echelle 1 : 4000.000.

3. OFFICIAL

The "Provincia de Angola" is a Portuguese colony.

The *land* is divided into several districts, with their own governor. At the head of these, there is an alto-commissario (governor-general), situated in Loanda. Besides the civil districts there are some military ones. Separated over the whole country there are a number of fortresses, generally without a good garrison (some negroes), and one or two white men, military or civil officers, who do police service. The seats of the district and section governors, are in towns and villages.

The *money* in Angola (nearly all in paper) is emitted by the Banco Ultramarino. The escudo (ancient milreis) has 100 centavos. The escudo of Angola is about 20 % lower than the Portuguese escudo, and had in 1925 a value of about 2 pennies. The most current smaller money are notes of 50 centavos, but they

are worthless outside of the colony. Conto is the name of 1000 escudos. English pound-notes are very gladly accepted in Angola, at a higher rate than is given in the banks and exchangeoffices. As to paying for things and people down country, it is necessary to take with you several bundles of notes of a half and one escudo.

Custom house. The duties vary in many ports, and it also varies according to the port whence you come or the nationality of the ship that brought you.

Gold-coins, books, geometric and other instruments are free.

It is prohibited to import alcoholic liquors, silver- and copper-coins and Portuguese money, the latter if the traveller is not coming from a Portuguese harbour.

There are high duties for importation of a photographic aparatus (20 % of the value) but when taking one for your personal use, payment is seldom required. Concerning victuals, see § 8.

It costs some trouble to import rifles, guns and cartridges. It is said that the Portuguese are very anxious to prevent the natives from obtaining arms and ammunition. For carriing arms and using them you must have a license (Alvara di Licença para uso e porte de Arma) from the Governo Geral. When in possession of this license, valid for one year, you are allowed to carry two rifles and 200 cartridges a rifle. Besides this, it is necessary to obtain a permit from the Military Headquarters to import arms. Then the arms have to be registered at various offices. Besides the gun-license it is necessary to obtain a license for big-game hunting. Travellers have to pay 30 esc. for an

ordinary shooting-licence; the costs of the special one are 50 esc. Residents have to pay half of these prices. Some big animals are protected by the law, e.g., elephant, giraffe, and zebra. It is absolutely prohibited to kill these, except with a very special license. It will cost at least two days to arrange all this. (Besides those animals prohibited by the law, there are others that must not be killed, for they contain the souls of the dead chiefs of some tribes; the hyena is sometimes one of these animals).

It is prohibited to export ivory coins of metal.

In the harbour of debarcation you have to report yourself at the office of the government and leave your pass for one day. The next day it is visad for a permit to stay in Angola for the time you indicate. The costs for staying half a year are about 20 escudos. In all the section-offices, in the villages and towns spread all over the land, you have to show your passport.

At your departure, before you can get a ticket for the journey home, it is necessary to obtain a permit for leaving the country again. (This costs 35 esc.).

4. POPULATION

Angola being a Portuguese colony, most of the white men (some 10.000) are Portuguese. Besides these, there are some of all nations of the world. Important are about 1000 South Africans, living in the neighbourhoud of Humpata in the South.

The number of the mulatos is estimated to be about 20.000. They have the same rights as the Portuguese.

Since the revolution in 1910, the natives are regarded as Portuguese, though without quite the same rights. The natives are Bantu-negroes divided into many tribes and villages with their own chiefs. In the south and southeast live isolated bushman-families.

The population is thin in the south, where the country is desert or steppe; and in the north great territories have suffered from sleeping sickness.

In general the natives are not bad, but sometimes they are not content with the Portuguese government and are rebellious. There are still some chiefs who are dangerous. It is wise to get reliable information from the authorities or the fathers of a mission. Here and there the natives use poisoned arrows. Only in some places, namely in the south, have they rifles.

5. LANGUAGE

The official language in Angola is Portuguese. Many of the higher Portuguese employers and officers speak some French or Spanish. English is not often spoken and German very seldom. In the south, near Humpata there live some two hundred South-African families who speak Dutch (South-African).

The natives speak several languages very different from one another. There have been distinguised some main languages, the other are dialects of these. There are very few white men who can speak one or more dialects fluently. Some missionaries speak it excellently and have prepared a grammar for some of the dialects or little dictionaries for travellers.

There are grammars of the Kimbundu (Bimbundu or Vimbundu or Umbundu; spoken in Cuanza do Sul and Benguella) another of Umbundu (idem); Lunda (N. E. of Angola); Ovambo (frontier in the South). The latter is the only German text, the others are Portuguese, (see Marquardsen). Most of these books are hardly obtainable. Not mentioned by Marquardsen is: Ensaios de Grammatica Nyaneka, by A. M. Lang, missionario in Tchibinguiro, districto de Huilla. (Lisboa, 1906).

In the Western regions, viz., near the settlements of the white men, a good many natives speak Portuguese, near Humpata many of them speak Dutch, and near the southern frontier German. For the rest, a very good manner of making yourself understood, is to show photographs or samples of the things you seek.

6. ARTICLES OF BARTER

Often the negroes will take money for their service. Money can be taken with you in bundles of banknotes of 1 escudo (about 2 pennies in 1925) or of 50 centavos (1 penny). Sometimes the natives ask for quinine, or for eyewash, fevers and inflammation of the eyelids being frequent. Matches are very desirable, also cigarettes and tobacco; and some tribes take snuff. For many articles, as beads, particular colours or shapes do not matter. At one time an article may be much in fashion, and at another time the same thing is not wanted at all. Needles are often wanted by women. Sometimes a chief desires for himself, in exchange for the men he is willing to give, pieces of cloth. It is prohibited to give them arms and ammunition.

Things of metal, like empty cartridge-cases, safety-pins and padlocks are often gladly accepted. Many tribes like very much for the women a special kind of large shell (gastropod).

7. CLIMATE AND TRAVELLING SEASON

Angola has on the average a considerable altitude (over 1000 M.). In most places the transition from the lower coast territory to the highland is rather abrupt in places being an escarpment over 1200 meters high.

Loanda possesses the head station of the meteorological service. In several other places there are stations.

Angola is situated entirely in the tropics. The influence of the altitude and the cold seacurrent along the coast upon the average temperature, is enormous, especially in the south. Many regions possess only a subtropical climate. In the winter season it is often rather cold in the evening and at night. On the Planalto (highland) of Mossamedes there are sometimes nightfrosts. Therefore, never take too few clothes with you. Great changes of temperature sometimes cause inflammation of the trachea.

The best season for travel is the dry period, the winter time of the southern hemisphere: in the south from May till the end of October; in the north (here there are two wet periods separated by a short dry season) from May till the beginning of December. Sometimes the rain fails to come for a long time. In the south the quantity of rain is very small. Near Mossamedes and in the regions south of it, it practically

never rains. The whole maritime country has relatively little rainfall. In the interior, some hundred kilometers away from the coast it rains on an average more than 1000 mm. a year.

8. FOOD AND DRINK

The food of the negroes consists mainly of maize meal (fuba) with some meat (fresh or dried) or some dried fish (bacalhau) You must count 1 K.G. fuba a head and a day.

The white men can take with them rice, potatoes, salt, preserves (vegetables, fruits, meat, fish), dried fruits, fish, tins with milk, olive oil (the Portuguese do not always like good oil), tea, a good provision of sugar and coffee, some Swiss cheese in tin foil, tins with butter, with fat, cakes, biscuits, also strong baked bread. Of course this all depends on personal taste. Big and little game is often plentiful, but an expedition, not bent on shooting only, cannot count upon a regular supply of meat, sufficient for themselves and the negroes, by hunting. Often the negroes know how to preserve and dry meat, cut in fillets, in an excellent manner. On the march this dried meat is a welcome refreshment. Before you can eat it, it has to be heated in the hot ashes of a fire, and then you can take it with you in your pockets. Eventually you can make porridge with fuba, sugar and milk. Fuba with salt and water may be used for baking bread (the flour must be ground very well).

Do not forget an abundance of matches, packed in more than one box (one box may become wet, or

may get lost). Besides being very useful for the expedition itself, it is a much desired article of barter. The same thing may be said of cigarettes and tobacco.

The preserves are obtainable in many stores in Angola; generally they are not very cheap. To take all this with you from your own country has its advantages (e.g. you can get whatever you want) but often it leads to trouble and expense at the custom-house. The import-duties pro K.G. of butter, flesh and preserves are esc. 0.15, of rice and flour esc. 0.02—0.03. Besides this, there is another duty of 10 % ad valorem. Vegetables are free from duties.

The waterproblem sometimes gives much trouble, especially in the south. Here, in vast stretches and regions there are only very few places where there are holes in the rock, or places in dry rivers, where there is some muddy water; not seldom these spots are also dry and the guide, who was to take you to a camp with water, finds nothing that is drinkable. You should seek reliable information, and be prudent. Neither is there water everywhere in the north, although the conditions are far better. To boil and to filter water is absolute drinking necessary. The taste of the water from stagnant pools is often very bad and water from the pools in the riverbeds is often saltish. For drinking purposes it is usually better to make tea or coffee. If possible, it is best to dig a hole in the sand at some distance from a pool, and draw the necessary water out of this hole. Water, tea or coffee can be transported, on the road, in watersacks or in case-bottles. In watersacks, the drink remains agreeably cool, but often they do not serve long, and begin

to leak, besides being easily soiled. Water for some days can be best transported in big tins of benzine or gasoline.

Some tribes of negroes know how to make an agreable drink with fuba, fermented in water that has been poured on it boiling hot, in a hollow calabash. It is called in the south "belungua".

9. EQUIPMENT

The equipment is the same as in all other tropical or subtropical regions, and depends on the comfort wanted, on the duration of the expedition, on the scientific aim, etc.

Indispensable is the mosquito-netting or -tent; nearly everywhere there are mosquitoes more or less. Take plenty of blankets with you: the nights are sometimes very cool. Your camp-bed must have legs, against reptiles and insects. In the time of the rains a rainproof tent with a second roof is necessary. Don't forget a barometer (aneroid), compass, thermometer, waterfilter, photo-apparatus with a great number of films for the tropics, flash lights and developing powders (for they are not always obtainable in Loanda, etc.[1])) binoculars,guns (f.e.a 8 mm. Mauser and a rifle)with ammunition and maps. Most things may

[1]) I think the best thing to do is to develop your photographs directly after they have been taken, for delay makes it possible for the plates or films to get veiled. Besides, spoiled photographs can sometimes be retaken. In the beginning it is not easy to take good photographs in the tropics. Ask an expert, or consult a good book. Don't give the films and plates too short an exposure! Ask for tropical material and packing; keep it cool.

be locked up in little steel boxes. Add a sleeping outfit, clothes, cooking utensils, folding table and folding canvas deck-chair, canvas water bucket, bath and washstand, chopping-knives and hammers. Perhaps a radioapparatus may serve, the larger towns having radio stations.

Usually 15—25 carriers are sufficient for a small expedition of two weeks. If the journey is to be longer, more porters are necessary for the food supply, if it is impossible to get food during the expedition. Authorities may give information on this subject.

For illumination, ordinary (ore) mining lamps are very useful, lamps burning with acetylene gas. Carbide can be bought anywhere in the towns. Be sure to take with you sufficient reserve burners, filters, etc., and some very thin needles (prickers) and brushes for cleaning the burner. It is good to take some dozen or two of candles with you, for reserve.

As there are many thorns and much long and sharp grass,with disagreeable seeds, I prefer, leather leggings; they are the most serviceable, but puttees are usually much more agreeable to wear if you make a long march. Boots should be of the best possible quality, and it is advisable to bring them with you from the land from from which you come. Mountain shoes are good, but lighter shoes are usually better. Rubber soles and heels are useful. The shoes must be very well preserved. Do not let them become too dry. Sun helmets are used, especially in the north. In winter in the south a broad-brimmed felt hat is agreeable. In the coast-belt warm underclothes and a thick coat are often needed. Where riding or pack animals are used, it is advisable to wear

long trousers completely closed in front and round the legs.

As for the travelling-surgery, see § 12.

10. TRANSPORT

The way to come to Angola is by ship. The principal steam-navigation companies are the Campanhia Nacional de Navigaçãu, Lisboa, (which with its passenger-ships puts in at Loanda, Porto Amboim, Lobito (Benguella) and Mossamedes and with its cargo steamers reaches other ports), and the Deutsche Ost Afrika Linie, Hamburg, which touches at Loanda and Lobito. It is also possible to go by steamer to any harbour of the Belgian Congo, for the river Congo (for about 130 KM. the frontier with Angola) is navigable for sea-steamers over the whole distance nearly. Some British lines touch Lobito also. All ports, except Lobito, possess a more or less good roadstead where unloading and embarkation take place in boats. Lobito possesses a landing-place, where loading and unloading may take place directly from railway carriages.

Loanda possesses a railway as far east as Malange (± 500 K.M.). Malange is situated ± 1000 M. above sea level. The railway of Benguella, which begins in the harbour of Lobito and is projected to the Belgian Katanga, has already passed Bihé (altitude 1700 M.) and is finished up to Camacupa (700 K.M.). From Porto Amboim a railway is in use to Gabéla. The railway from Mossamedes to the east is finished up to Lubango and almost to Humpata (altitude ± 2000 M.). If you want to use the railway for a long distance, it is good to buy your tickets early. It is wise personally

to execute all commissions for while the people are very ready to help, they actually put leave everythnig until the next day.

Where there are roads, the transport may take place by automobile. Angola possesses many and good roads, kept up by the natives. Other roads are preserved very badly and all roads have much to suffer in times of rain. Maps, on which roads are indicated, must be employed with much reserve. Nearly always the indication is not exact. Many regions are not fit to be travelled over without a very good guide.

In Angola there are already many motorcars, of all sorts, of different sizes and for all use. Ford motorcars are especially popular, they may be used in bad and difficult fields and the costs are low. There is a great wear and tear as to tires, because there are many sharp stones and thorns.

Motor bicycles are seldom used and the same may be said of bicycles. Perhaps the latter could be used on some roads in the dry season in combination with a motorcar, but to take them with you is not advisable.

Where the roads are too bad for motorcars, they use in the south cars on two wheels, (*car-boer*) drawn by 8—20 oxen. (= 4—10 yoke) or more. Upon better roads wagons on four wheels are used too. The full tented wagon on four wheels is rarely employed now. So you may transport much cargo over bad roads. In the north the dreaded tsetse-fly makes this mode of transport impossible. In the south there are other cattle sicknesses, sometimes of epidemic character, but on the whole you can travel here with the car-boer very safely. The transport by car-boer may be used in

combination with riding animals. Oxen are better for tracking than other animals, for the oxen eat what they find growing, but you have to take fodder, e.g. maize, with you for horses or donkeys. One "trek" is to be calculated at about 15 K.M.: without a rest, the oxen track 15 K.M. They can do two treks a day. The oxen must drink several times a day, but in case of necessity they can do without for one day. The light car-boer may be loaded with about 500 K.G., a heavy one with much more.

Two preto's (natives) are necessary to drive the car-boer. One is the driver, the other drives also but has moreover to look after the oxen to give them drink and food. Sometimes the driver requests for this purpose a small boy.

A good deal of practical hints given by Wagner and Trevor, about all kinds of transport mentioned, are also of great value in Angola.

Riding animals in Angola are mules and donkeys, as horses nearly all die from horse-sickness. Therefore horses are very difficult to get and as a rule not very good. Good riding mules are also difficult to obtain. Ordinary mules and donkeys are very slow and the natives, going on foot, can keep up with you easily. (Riding oxen are also employed sometimes). Riding animals have the very uncomfortable quality of being often covered with ticks and other vermin, that may be dangerous to man and give rise to inflammation.

Pack animals are seldom heard of in Angola. Pack mules and donkeys should be useful in many parts. Pack oxen are used in some places. In the desert of the southern part they have used camels for packing and

The Car-boer.

A rest in the southern Desert.

riding purposes as they do now in the Kalahari and in N. E. Rodesia. Few of them are still in Angola to day.

The prices of animals in relation to those of South Africa are generally very low, the escudo being now very low. It is useless to give detailed prices, for they change rapidly. In 1925 a good trek ox did not cost more than 4 £) [1]) Sometimes carts, wagons and animals can be hired.

Where there are no roads for motor-cars or carriages all cargo is ordinary *carried by natives*. The Portuguese law prohibits cargo of more than 30 K.G. All luggage is therefore to be divided in a number of packages of that weight. For that purpose little steel trunks or boxes are very good. Victuals for the natives may be transported in bags and sacks.

It is not always easy to obtain porters or workmen. Often the Government must be consulted about it. About the honesty and good faith of the natives there are different opinions and this is different with all tribes and depends of course on circumstances. I do not think most of them are thieves, but opportunity may make them thieves.

Besides the bearers, necessary for all the loads, an expedition needs a cook (who takes with him a light weight of kitchen utensils) and a cook's mate (generally the latter can be taken from the bearers or the tent-boy can do that), one or two tent-boys, who must take care of the tent, clothes, boots, etc., a gun-boy and a boy for carrying the scientific instruments, photo-aparatus, etc., and who can carry things that are col-

[1]) Not all things are cheap. Imported goods are generally very expensive.

lected during the day. A guide and an interpreter are very useful too. The guide may be recruited in the villages that you pass. The interpreter may be a native, who speaks Portuguese (as many of them do in the towns, where the expedition begins) or a mulatto. A white man may be useful as guide or interpreter, but he will nearly always require a native servant, few white men being able to speak the language of the natives fluently. But some white men can translate the Portuguese in to another tongue. In the regions where water is scarce, it is often difficult to get a guide able and willing to indicate the places with water for 1°, there are very few men; 2°, the people are very shy and they do not always have huts, therefore it is very difficult to catch them; and 3°, they do not want to indicate water (sometimes their only possession) to the whites.

The wages are low now. A carrier is paid with 1—2 escudos a day (2—4 penny), the cook, tent-boy, gun-bearer, etc., 3—8 esc., with their food (the value of this is estimated upon about $1\frac{1}{2}$ escudo) and from time to time some tobacco. Every month they require a jersey or shirt and trousers. They generally take their own blankets, knives, etc., with them. It is good to arrange before the departure about cooking-pots and all food and to promise to give something at the end of the excursion, e.g., a knife, a jersey, etc. Sometimes it is advisable, if possible, to change porters every two or three weeks. In the jungle sometimes money is not accepted but goods are: yards of cloth, etc., sometimes to be paid to the chief of a village. The food of the natives must be calculated at about 1 K.G. maize

A Ferry-boat near Porto Amboim.

They had said, it was a good road.

meal (fuba) a day with some dried fish or flesh or dried meat. The food is a great handicap, for, on a fortnightly trip, each porter can but take on an average 15 K.G. of food, that is, half the load he bears. The advantage is, that during the expedition they can easily take with them gathered collections in the place of food consumed. In every-thing, the best thing to do is (if possible) to fill up the food containers at least every ten days. Often there is no certainty about furnishing meat by shooting game.

In some regions there is a sort of sedan-chair in use, carried by four negroes. Sometimes a hammock is used for that purpose. In case of sickness, or for ladies, it may have its merits.

Transport on the water, except along the coast at sea, does not take place often during an expedition. In the western part there are good roads, but sometimes on the rivers little steamers may be used too. People can go up the river Congo about 130 K.M. with sea-going steamers. The Cuanza is navigable over great distances separated by falls and cataracts. The Cunene is also navigable in some parts. In Angola the Kubango, tributary of the Zambesi, also is partly navigable by canoes. Lack of good and strong canoes makes it impossible to be sure of being able to travel with them. Over some rivers there are primitive ferry boats, that can also accomodate motor-cars.

In addition to those things communicated by Wagner and Trevor, about *air travelling*, I think that there are great possibilities for exploration by aeroplanes (aerial photographic mapping and surveying); especially in the southern part of Angola but also in the north.

In the south the water supply will perhaps remain a difficult thing. Near Humpata there is already a military air-camp.

11. CAMPSITES

The choosing of a site for a camp is quite the same as in all other countries. In the dry season one may pay less heed of the place than in a time of rain. Be careful in selecting a site in a dry riverbed (molola and damba) at the end of the dry time. Then it is possible that the dry bed of the river fills itself with water in a very short time, when there have been heavy rains in the upper course. Of course the camp must be favourably situated especially with regard to water. In the dry time the tent is not necessary but the mosquito-netting is. When you have to make a camp in long dry grass, it is best to burn it down in a circle, but take care not to set fire to the whole surrounding field. In the summer season the camp must be erected on high ground, so that the rainwater can do no damage by running under the tent. Sometimes a ditch is usefull. It is not advisable to erect the camp too near the water or too near the nests of termites and ants.

Sometimes, when you camp several times on the same place, grasshuts may be erected, with mosquito-proof doors and windows. They are water-proof and cool. An old native hut will not serve, infested as it is with vermin and snakes, besides being uncomfortably built.

12. HEALTH

There are a certain number of malaria mosquitos everywhere. It is necessary to take with you a mosquitario. It is advisable to take as a prevention a little ortion of quinine daily. North of the 12th degree S., in very many territories the terrible sleeping sickness reigns caused by the glossine fly. Be very careful here.

Do not always eat conserved foods in tins; try to get milk, eggs, vegetables, etc. They, being prepared well, are less liable to cause sickness.

In the summer, and at the time of greatest warmth do not try to do too much in the hottest part of the day. Take a rest from 12—3 p.m. A knowledge of first-aid with accidents is necessary; take bandages, etc., with you.

As to medicines for travelling surgery, ask a specialist in tropical illnesses or consult one of the indicated handbooks of travel. Do not omit ammonia for bathing bites of insects, for there are agressive specimens. Take with you insect powder and other preventatives for vermin and ticks. There are many snakes and scorpions; see what Wagner and Trevor say about snake-bite.

It is good to take some alcohol-bearing drinks, e.g., cognac with you, not for barter purposes, but as a tonic, after great fatigue or as medicine.

SCIENTIFIC TRAVEL IN AUSTRALIA

BY

GRIFFITH TAYLOR. D.SC., B.A., F. R. G. S.
Professor of Geography, University of Sydney

R. LOCKHART JACK. B. E.
Assistant Government Geologist for South-Australia

H. BASEDOW. M. A., M. D., B. SC.
Formerly Chief Protector of Arborigines in the Northern Territory

R. H. CAMBAGE. L. S., F. L. S.
Hon. Secretary-Royal Society of New South Wales
and

MARJORIE J. SHIELS. M. SC., F. L. S.
Late Macleay Fellow in Botany

SCIENTIFIC TRAVEL IN AUSTRALIA

CONTENTS

PART I

BY GRIFFITH TAYLOR

1. Introduction, Institutions etc. 75
2. Climate and Settlement 78
3. Communications and Travel generally . . . 82
4. Additional Details. 84
5. Travel in the Frontiers of Settlement 85

PART II

6. Travel in uninhabited Central Australia by R. LOCKHART JACK 90
7. The Primitive Australian Arboriginal by H. BASEDOW 96
8. Botanical Travel in Australia 103
   A. In Eastern Australia by R. H. CAMBAGE 103
   B. In the Arid Parts of Australia by MARJORIE J. SHIELS 106

PART I

1. INTRODUCTION, INSTITUTIONS, etc.

Australia has a large area, about three-quarters that of Europe, and for this reason includes a number of

very different environments. The traveller who has not yet visited Australia is, as a rule, not prepared for this diversity, which is as different as that met with between the British Isles and the Gulf of Guinea.

There are a number of institutions in England where much helpful information may be obtained, though generally it concerns economic rather than scientific matters. The High Commissioner's office and the offices of the Agents-General for the several States are readily accessible in London. There also are to be found the Royal Colonial Institute, and the maps and library of the Royal Geographical Society, where much published data can easily be consulted.

The following books among others give a wealth of information of value to the scientist:

1. *Commonwealth Year Book* (annual) Melbourne. The authoritative source for statistics, with a long bibliography, and with special scientific articles in each annual number.
2. *Federal Handbook* (for the British Association) 1914. 598 pages by experts dealing with all branches of science.
3. *The Aborigines*. Works by A. W. Howitt, B. Spencer and H. Basedow.
4. *Economic Development*. Works by R. C. Mills, H. Heaton and S. R. Robertson.
5. *Botany*. Works by J. H. Maiden, D. Hutchins and R. T. Baker.
6. *Zoology*. Works by J. A. Leach, A. H. Lucas, G. Matthews and W. H. Le Soeuf.
7. *Geography and Meteorology*. Works by G. Price, G. Woods and G. Taylor.

8. *Geology*. Works by W. Howchin, J. Gregory and T. W. E. David (1926).

Unfortunately few of the above books are comprehensive. They deal with one State or with one aspect of the science. The Australian Encyclopedia (2 volumes) which will be issued in 1926 contains lengthy modern articles on most subjects of recent scientific interest.

The annotated bibliography of recent scientific papers published by the Australian National Research Council is also of great value.

Upon arrival in Australia the visitor will find that each capital city is equipped with large libraries, with universities, and with museums and scientific societies. He will do well to get in touch with the authority on his particular subject in each State. At each of the six capital cities there is a Royal Society devoted to all branches of science. In Sydney there is also the Linnean Society which primarily studies Natural Science. There are geographical societies at Brisbane and Adelaide. Departments of Geology, Botany and Zoology are found at most of the Universities, while departments of Geography (largely devoted to the study of the Australian Environment) and of Cultural Anthropology are found only at Sydney.

As regards maps, these have been made chiefly in the Lands Departments of the State governments for purposes of land-sale or pastoral leases. In the settled districts parish maps are available with a scale of one or two miles to the inch. They show roads and rivers, creeks, etc., but, for the most part, make no attempt

to indicate elevations. Only around the capital cities have any contour maps been prepared, and they are not available to the public. The writer compiled a Commonwealth orographic map, which was published by the Weather Bureau at Melbourne. Approximate State orographic maps can be obtained in some of the capitals.

For the sparsely-settled regions pastoral, (and sometimes) geological maps are available. They are drawn to a small scale, and rarely give much topographic information.

The Weather Bureau (Melbourne) publishes a large wall-map of the isohyets or rainfall lines of Australia, to a scale of 35 miles to the inch, which gives the key to the distribution of settlement.

2. CLIMATE AND SETTLEMENT

In a sub-tropical continent like Australia the time of visit should depend a good deal on the region to be studied.

Speaking generally January and February are unpleasantly hot for Europeans and Americans in most of the Commonwealth. In the tropical third of Australia these months are very humid, though in the south-west the dry summer makes them less oppressive. [1])

As shown in Figure 1, a line running across Australia from North West Cape to Sydney divides the summer- rain region (north) from the winter-rain region (south). The east coast, however, has fairly uniform rains, whereas the centre and central-west coast have

[1]) For details see 'Australian Meteorology' Oxford, 1920, by Griffith Taylor.

negligible rains. Thus in the north and northwest the most satisfactory season is probably the early winter before the dry spring has led to the drying up of waterholes, etc. In the northeast the winter is the best season, since there is rarely any shortage of water. In the east and south any months excluding midsummer are pleasant; though in the south the winters are rather wet, the climate is very like that of Britain in consequence.

A vast area of Australia (nearly half) is arid, and here travel away from established routes depends on the availability of water. In most parts the winter is drier than the summer, but rains are erratic, and many of the less-known regions can only be visited after fairly widespread rains have fallen. For this reason travellers' reports of such regions are often unduly optimistic.

The maps given in Figures 1 and 2 illustrate the above facts fairly clearly. As regards temperature the following table gives the chief data, and also shows similar regions (homoclimes) in other parts of the world.

Australian and Foreign Homoclimes

The range of temperature in Australia is small, owing to the fact that even the centre is not far from the ocean. Thus only in a narrow belt from Marble Bar to Bourke (see figure 3) does the annual range exceed 32° F. On the other hand the same belt experiences very long periods of hot weather in summer. In a recent summer Marble Bar registered a maximum

Australian Locality	Temperature			Rainfall			Similar Foreign Locality
	Average Deg. F.	Hottest Month.	Coldest Month.	Average in inches	Wettest Month	Driest Month	
A. Broome W A . .	79.8	85.9	70.3	23	6	0	A. Banana (R. Congo).
B. Nullagine W A .	79.8	85.9	70.3	23	3	0	B. Colima (Mexico).
C. Carnarvon W A .	71.0	80.0	60.0	9	3	0	C. Olukonda (SW. Africa).
D. Wiluna W A . .	70.0	85.0	52.0	10	2	0	D. Windhoek (SW. Africa)
E. Darwin N T . . .	83.0	84.0	77.0	62	15	0	E. Cuttack (East of India).
F. Daly Waters N T	80.0	87.0	69.0	27	6	0	F. Quixeramobim (Brazil).
G. Alice Springs N T	70.0	84.0	53.0	11	2	0	G. Biskra (Algeria).
H. Townsville Q . .	78.0	82.0	66.0	49	11	0	H. Calcutta.
I. Wyndham W A .	84.5	88.3	76.2	27	8	0	I. Tinnevelli. (S. India)
J. Perth W A . . .	64.0	73.6	55.0	33	6	0	J. Capetown.
K. Brisbane Q . . .	68.8	77.2	58.0	47	7	2	K. Durban.
L. Sydney NSW . .	63.0	71.6	52.3	48	5	3	L. Wilmington. (N.C.)
M. Melbourne Vic . .	58.3	67.5	48.4	26	3	2	M. Oporto.
N. Launceston T. . .	54.8	64.5	44.1	28	3	1	N. Falmouth.

daily temperature above 110° F day after day for 3½ months.

In figure 2 the salient features of the settlement of the Commonwealth are illustrated. Rugged mountains are confined almost entirely to the eastern agricultural belt. Elsewhere aridity is the chief physical factor affecting settlement. The *agricultural* region is adequately served by railways and good roads. Almost all this land is alienated from the government. Here alone are found the forests, though thick 'scrubs' of smaller trees (largely acacias or 'mallee' eucalypts) are common in the drier regions.

The belt labelled '*good pastoral*' is covered by large pastoral holdings called 'stations'. These are chiefly sheep in the south and cattle in the north. This region is served by a few railways, but motor transport is almost universal. The innermost occupied belt is marked '*sparse stock*'. Here the better country is occupied permanently by stations, but large areas of poor country are not yet leased from the government. Here again motor-cars have recently become ubiquitous, though naturally the routes are very rough. In the northern coastlands the grasses are coarse and thick and the empty country is proportionately more abundant [1]).

Finally there are two large *descrt* areas where there is no stock and no settlement today. These are marked 'Uninhabited'. Here there are naturally no roads, but the country consists of vast rocky plains or 'fixed' dunes. Here is the last stronghold of the wild abori-

[1]) For details see 'Australia, Physiographic & Economic' 4th edition, 1925, by Griffith Taylor (Oxford).

gines. The general character of these regions is well-known from the early explorers, reports and from numerous recent geological reports. The grandiloquent programs of so-called explorers purporting to explore unknown Australia receive very little attention in Australia itself. As a matter of fact almost all the inhabited country was fairly well known by 1862 and folk have settled on the frontiers of the uninhabited areas for 30 years. It is only their unsuitability for stock, not their inaccessibility, which has kept them empty.

3. COMMUNICATIONS AND TRAVEL GENERALLY

From what has been written already it will be realised that there is no difficulty in travelling anywhere in the east and south of Australia. But in the sparsely populated portions the facilities for public transport very quickly deteriorate.

The almost universal method is by means of private motor transport, which is subsidised by the governments to carry the mails. These cars travel at regular intervals and almost always carry a few passengers at rates which vary from place to place, and are generally a matter of private contract. In Figure 3 I show the chief transport lines in the 'sparselands' of Australia. (It is based on a map which I published in the Geographical Review, January, 1926). Fuller details are given on the excellent map published by the 'Inlander' (23, York Street, Sydney). The figures on the map mean 'days between services'. Thus the three

aerial services occur every 7 days. The railway train from Marree (S. A.) to Oodnadatta runs once in 14 days, as does that to Marble Bar (W.A.). The mailman (per motor) reaches Alice Springs in Central Australia once a fortnight from the south and every 40 days from the north. The service from Wyndham to Hall's Creek (in northern W.A.) runs once a month in the dry months, and once every two months in the wet season. In west-central West Australia the writer travelled from Marble Bar to Meekatharra (about 700 miles) by the mailman's car for about £ 13. On the other hand, £ 7 was demanded for a 50-mile run in the Northern Territory along a road which was off the regular mail track. It is of interest that during the last few years the use of the horse (or horse and buggy) has diminished to an extraordinary degree. The vast level stretches of arid Australia with their sandy or gravelly surfaces offer unique facilities for transport by strong motor cars. The vegetation is negligible or consists of thin-stemmed 'mulgas', etc., which can readily be cleared and do not grow again very rapidly.

As regards steamers, they sail almost daily around the coast from Townsville (Q) to Fremantle (W.A.). From Townsville to Darwin there is a boat usually once a fortnight, which goes on to Java. From Fremantle (W.A.) to Broome there is a boat about every ten days and once a month this goes on to Darwin.

The aeroplane service along the west coast carries from 2 to 4 passengers as well as specially-paid letters. It flies a thousand miles (in three relays) to Broome. The fare is about £ 20. An extension is made to Derby on Saturday afternoons.

4. ADDITIONAL DETAILS

Australia is a particularly easy country to travel in compared with many others dealt with in this series of handbooks. In so many lands problems concerning Natives, Hygiene, Clothing and Wild Animals bulk largely. In Australia the traveller hardly needs to consider these at all. Only in the totally uninhabited regions are the blacks to be considered to some degree, as Mr. Jack describes.

As regards *Hygiene* the temporary dweller in the greater part of Australia has nothing to fear. In the northern coastlands there is a little malaria and dengue and some hookworm trouble among the white residents. But ordinary precautions will keep the visitor quite free from these, and year by year the tropics are becoming less liable to them. This is largely owing to the absence of any notable coloured population.

Clothing is much the same from one end of out-door Australia to the other. A broad felt hat, a flannel shirt, strong trousers and boots and socks clothe the worker throughout. There are no specialised articles of clothing. Khaki drill is sometimes used, but provided that the clothes are not hot, and yet prevent chill, if a somewhat sudden drop in temperature occurs, any ordinary rig will suffice. Adequate under-clothing is of course required in the centre and south in winter. Throughout Australia the only wild creatures to beware of are the snakes. These are, however, very rarely met with; and both the harmless and poisonous species are usually glad enough to keep out of man's way.

Camping-out is often necessary in out of the way districts. The Australian almost invariably uses a tent and 'fly'. The tent is made of canvas or duck and is oblong in plan with a ridged roof suspended on a rope lashed between two trees. Guy-ropes attach the four corners of the tent to the ground. The 'fly' is a simple sheet of similar texture slung over the tent forming a second roof. Neither tent nor fly is perfectly waterproof, but any drops of rain soaking through the upper fly are kept back by the tent. The tents vary in size, the smallest has a ground space of 6×8 feet. For four people a space of 8×10 feet is more comfortable. Tea is the universal beverage, boiled in a tin 'billy' over the camp fire. A frying-pan for bacon, eggs or chops completes the cooking apparatus in many cases.

The 'swaggie' or 'sundowner', as the peripatetic stationlabourer is called, carries his tent in one roll and his bundle of blankets in another. Hanging these over his shoulder he tramps from one side of the State to the other. There is no limit to the additions which may be made to this simple method of travel, but the whole technique is so simple that the traveller will grasp all that is essential as soon as he comes in contact with it, so that further description seems superfluous.

5. TRAVEL IN THE FRONTIERS OF SETTLEMENT

Some account of a journey in West Australia will give the reader a clear idea as to methods and costs.

Similar conditions prevail throughout the vast region of rather sparsely occupied pastoral lands. These lie between the settled districts with their quite ordinary methods of travel and the uninhabited region for which special methods are described later by Mr. Jack. My special object was to make a traverse of the borders of settlement from north to south of the State.

The following table gives an idea of railway speeds on the Interstate railways. One can leave Brisbane for Perth on Saturday, Tuesday or Thursday. Suppose we choose the first day.

Saturday	Brisbane	8.5 am.
Sunday	Sydney	11.25 am.—7.25 pm.
Monday	Melbourne	12.51 pm.—4.30 pm.
Tuesday	Adelaide	9.55 am.—10.45 am
Wednesday . . .	Ooldea	3.10 pm.
Thursday	Kalgoorlie	1.38 pm.
Friday	Perth	9.47 am.

The total distance is 3476 miles, and the first class single fare is £ 22—16—11d. This includes meals and berths from Port Augusta to Perth.

From Fremantle (the Port of Perth) comfortable boats of 3 or 4 thousand tons such as the Bambra, Gorgon, etc., travel about once a fortnight up the west coast. From Fremantle to Broome (first class) costs £ 13—15 single and £ 22 return. (There is no second class usually). This is a distance of about 1546 miles. After leaving Geraldton there is only sparse settlement all round the west and northern coastlands until one reaches Cairns in NE. Queensland. Some of the ports of the western coast have long

S.S. Gorgon at Broome (W. A.) showing ship resting on sea floor at low tide.

Photo G. Taylor.

West Australian air service. The plane leaving Broome for the first section to Port Hedland.

Photo G. Taylor.

jetties, but at others passengers are landed by means of lighters. The very costly wharf at Point Samson was destroyed by a hurricane a few days after we had visited that isolated port, which merely leads to inland pastoral and mining settlements.

At Broome ships can only enter at high tides, which here are exceptionally strong, sometimes reaching 30 feet. There are several comfortable hotels, where accommodation costs about £3 per week. The visitor with letters of introduction should have no difficulty in seeing something of the cattle 'stations' in the hinterland, but it is well to make arrangements by letter some weeks beforehand, as there is no public conveyance to these 'outback' stations. With the consent of the manager it is easy to get into touch with the semi-wild aborigines who usually have a camp in the vicinity. Two or three days are necessary to gain their confidence; and gifts of tobacco and small silver, with promises of photographs, usually enable one to obtain photographic, anthropometric and language data.

From Broome the writer journeyed 320 miles by aeroplane over the interesting Northwest coast, where the desert sands blow out in vast yellow and red streaks over the Ocean. This journey occupied four hours, with one stop at Wallal, (noted for the eclipse). The cost was £7—10 to Port Hedland, where a mining railway runs inland 112 miles to Marble Bar. Luckily after waiting a day the fortnightly train left, and I made this journey at a cost of £1—8—6d.

There is invariably an hotel at these small inland mining towns, for a good deal of pastoral occupation

exists also. Here rough but ample accommodation can be obtained for about fifteen shillings per day. At the time of my visit fresh meat, milk and vegetables had not been available for six months; however, there was plenty of tinned food, though at double or treble Perth prices.

From Marble Bar I journeyed southwards for 700 miles to reach the railway at Meekatharra. The mailman uses a Dodge car, which carried the mailbags and in addition (with a trailer) accommodated seven passengers and 17 large bags of grain, etc.! On several occasions we did not reach a settlement by nightfall, and as it was summer slept on the ground under a tarpaulin sheet. Once or twice we used Government Rest House. This is a building containing four or five simple bedsteads, where one can sleep at a cost of one shilling per head. I have not found them in other States, however.

Except for a few small patches of sand-dunes we found the roads excellent for motor-cars. The roads are cleared of scrub, but no broken stone is added to the surface, for the natural gravel is sufficient in dry weather. This journey cost £ 13—10. I made private arrangements with the driver as to food. The cost was under one pound, for the stations *en route* were, as always, most hospitable.

Fig. 1.

FIG. 1. *Rainfall Control* (Some average temperatures added).

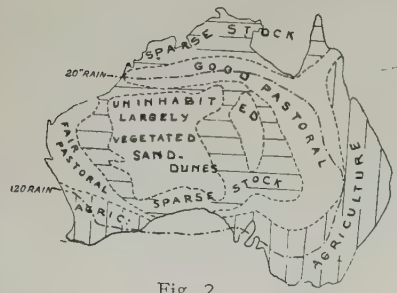


Fig. 2.

FIG. 2. (*Settlements Areas.* (Generalized).

Practically all Australia except the agricultural regions and the eastern edge of the good pastoral region is very sparsely inhabited.

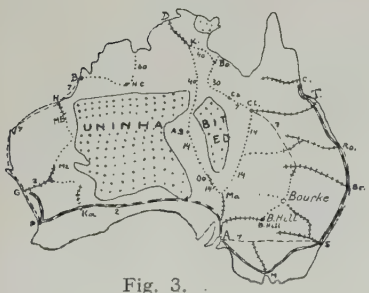


Fig. 3.

FIG. 3. *Communications.*

Most of the regular services in the sparse land are shown. Only the chief railways are indicated in the closely settled regions.

- main interstate and coast railways
- other main railways
- motor and other services
- air-services

Figures show days between services.

From west to east: G = Geraldton; P = Perth; Me = Meckatharra; H = Hedland; M.B = Marble Bar; Ka = Kalgoorlie; B = Broome; H.C. = Halls Creek; D = Darwin; K = Katherine; A.S. = Alice Springs; Oo. = Oodnadatta; Bo. = Borraloola; Ma. = Marree; A = Adelaide; = Ca = Camooweal; Cl = Cloncurry; M = Melbourne; C = Cairns; T. = Townsville; S = Sydney; Ro = Rockhampton; Br. = Brisbane.

Part II

6. TRAVEL IN UNINHABITED CENTRAL AUSTRALIA

BY

R. LOCKHART JACK

Australia may be described as having an eastern, a southern and a western belt of agricultural settlement in which accommodation, roads and transport are fully available.

Farther in is a much more complete zone of pastoral occupation, more or less served by railways, and in the whole of which the motor is now very largely used in journeys; with the horse, bullock, mule, donkey and camel, according to local conditions, for the heavier and slower transport work.

On the coast two patches of this belt are but little occupied:

Arnhem Land in the N.E. of the Territory on account of the rankness of the feed and its unsuitability for cattle; and on the south, near the S. W. corner of South Australia where the difficulty of obtaining stock water has only permitted very sparse settlement to take place.

But for these exceptions the outer limit of settlement is only reached when the country is penetrated to such a distance that the cost of transport, combined with the low rainfall renders the provision of water supply and occupation unprofitable. This is exemplified by the Overland Telegraph line and its consequent

motor track between Port Darwin and South Australia. Pastoral settlement has followed them, leaving spaces to the east and west still unoccupied. Within these pastoral areas the available waters, condition of tracks, and of feed are all known and either mapped or known locally in such detail as to enable travellers to find their way. If motoring, provision of petrol and arrangements to replenish supplies would have to be arranged for on routes that do not touch townships [1]). The stations in many cases have supplies, but they are for their own use in working the station and for pumping, so that the traveller should arrange for his own supplies.

Broadly speaking, pastoral settlement has occupied the country in which water occurs permanently or can be developed with some degree of success, so that to penetrate beyond these the traveller is dependent on the ephemeral surface waters of a good season, rock-holes, and soaks some of which are mapped and others of which are only known to the aborigines and which they may be disinclined to disclose. For this reason horses are not suitable for long journeys into the more arid portions. Camels, which even with dry feed, can do well enough without water for 6 or 7 days in fairly cool weather, and for much longer if the bush and herbage is green and succulent, are to be preferred. They will carry 500 lbs. apiece, and if specially good camels are available, 600—700 lbs. and

[1]) Mr. L. Keith Ward B.A. states that petrol is obtainable at Alice Springs (in central Australia) at 8/6 per gallon. It is 2/2 in Sydney today (Febr., 1926). No other supplies are obtainable to the north until the railway is reached at Katherine.

average 20 miles per day across country. They can be hired for about 5/— per week at some of the railheads, or bought, with saddles for about £ 20 apiece or upwards, the price to some extent depending on the time possible for selecting them. Europeans or Asiatics can be engaged as drivers for about £ 5 per week, and an aboriginal if obtainable (at a cost of about £ 1 per week) is very useful for tracking and collecting the camels in the mornings. Camels are belled and hobbled at night and allowed to graze, but if the bush is dry they are apt to wander, despite the hobbles, in search of water.

With heavily laden camels it is best to make the day's journey in one stage. Putting the camels down for an hour at mid-day is not much relief to them unless the loads are eased on to the ground, and the time spent reloading reduces the period of rest. With the one stage the day's journey is covered early and the best pasturage may be selected to camp on. To camp on a patch of favourite or succulent feed justifies the loss of one or two miles for the day as the camels will be close at hand next day, fit, and in time to do a long stage.

Much of the interior is very sandy and for this class of country the camel is indispensable, but if the region to be examined is not too sandy, and much informaation on this and other matters can be obtained from the State Lands & Survey Departments, it would be possible to work out by a car or cars from a base where stores, water or fuel could be got. Rates for car-hire are 1/3 to 2/— per mile, but for remote and difficult cross-country work the latter figure might

Transport in Central West Australia. Mailman's Dodge car and trailer carrying fodder to drought- stricken stock from Nullagine to the South-West.

Photo G. Taylor.

Government well on the stock route north of Peak Hill (W.A.) These wells are sunk every 12 miles.

Photo G. Taylor.

be exceeded. For car work in the interior off beaten tracks it is very advisable to use the winter months, as in summer the tires give much trouble owing to the softening of the rubber allowing sticks and twigs to penetrate easily. Sand also in hot weather, is much looser and great difficulty may be experienced in crossing sandy patches, which in cool weather are negotiated without difficulty. Whatever method of transport is adopted ample water suplies for the type of country traversed should be carried.

Food. Little dependence can be placed on game to supplement the stores. In a good season marsupials and rabbits may be got, but the bulk of supplies will have to be carried. For this reason the out-back fare is apt to be monotonous, flour and baking powder, salt meat, tea and sugar being the most readily obtainable and portable supplies. For quantities the old-time station weekly ration of 10 lbs. meat, 10 lbs. flour, 2 lbs. sugar, $\frac{1}{4}$ lb. tea is ample, but the traveller using this as a basis should substitute a variety as far as is possible. A proportion of the meat should be tinned, but the bulk is probably best obtained as dry salted meat at the last stations. Flour can be reduced by substituting a proportion of rice, onions, dried potatoes, dried fruits such as prunes and apricots, jam, etc. Some of these reduce the proportion of sugar slightly. Condiments are advisable. Tea is the universal bush drink, so that in practice doubtful waters are boiled. The risk is *hydatids* from the native animals. For the canvas waterbags water of good quality or boiled is used.

Natives. The aboriginal untouched by civilization has to be sought around the junction of South and Western Australia and the Northern Territory; a portion of the north of Western Australia; and Arnhem Land. In these areas it would be wise not to allow natives near the camp, nor to pitch the latter within spear-range of cover. For the rest the travellers' commonsense should be sufficient guide. In dry country it is not advisable to camp right on the only available water if there are blacks about, as they and their game supply may be kept off the water. Neither is it advisable to reduce a small supply, such as a rockhole, too far by a prolonged stoppage on it as this may provoke resentment. If their confidence can be gained they may be of great use as guides to the water supply of the region, but it should be remembered that an aboriginal's idea of "plenty water" is not always identical with that of a string of thirsty camels. Food, tomahawks, knives, clothing, and if they have been in contact with whites, money, pipes and tobacco appeal to them.

Collecting. With camels or packhorses solid specimens should be well wrapped to preserve them and their labels; while tanks and bottles containing specimens in liquid should be well packed with the former and then completely filled. These precautions are necessary as the surge and chafe produced by the motion of the pack animals will damage the specimens if they are free to move.

Personal and camp equipment. Any strong light clothing will suffice but woollen trousers in portions

of Australia are unsuitable as they gather grass seeds. Ordinary medium boots — not shoes — with rubber outer soles *screwed on* are very suitable, while either a wide felt hat or helmet is worn according to taste and locality. In summer a fly veil gives relief. The bush flies do not bite but are very annoying and persistent.

Meals taken very early and late avoid the pest.

In winter the nights are cold (below freezing point) and a coat is desirable. Camp gear is generally of the simplest description. A few billies, a camp oven for baking and roasting, cutlery and enamel ware is the usual equipment. A good tarpaulin is required to cover loads and pack-saddles in case of rain and for other purposes.

In summer collapsible stretchers are a luxury, if the weight can be afforded, as they keep one off the ground and free from wandering ants.

In winter the ground is preferable unless a mattress is carried — being warmer than a bare stretcher.

A mosquito net of suitable type can be obtained at the last store if there is a local demand for them.

Blankets are best rolled in a waterproof sheet 7 to 8 feet square which forms a ground sheet and at the same time serves as a shelter against rain.

Light tents and flies are obtainable but are not much used on the road unless weather conditions are very bad.

For a camp of more than a night they would of course be pitched and for a camp of some duration should be supplemented by a bough shed.

Surveying. A considerable proportion of the interior of Australia has been trigonometrically

surveyed and the detail, if obvious, filled in. Other portions have been sketch mapped from traverses of more or less accuracy. Maps showing the information available are to be had from the Department of Lands at a slight cost.

Much of the interior is sufficiently wooded to make distant sights difficult to get and the low relief of physical features in places makes their recognition difficult from other view points. Time and compass traverses to record the route followed, checked and corrected by sights to known points where possible or by observation affords a useful record of the route.

Costs. Costs are very largely a personal factor, depending on the number of persons sharing them, the scale of living and of equipment, the duration of a trip from the base of supplies and its total duration.

It is probable that a party of two — who would have to assist with the loading — with a camel man and aboriginal and hired camels could go out for three months carrying all supplies and water for 10 days at a total cost, including food, of about £ 12 per week, equal to say 2/— per mile travelled.

7. HOW SHOULD THE VISITING SCIENTIST APPROACH THE PRIMITIVE AUSTRALIAN ABORIGINAL?

BY

H. BASEDOW

By nature the Australian aboriginal is peaceable, humorsome, and tractable. Being primitive, however,

he is inclined to be covetous and revengeful; and if provoked may become treacherous. Under ordinary conditions, the anthropologist who visits the out-back tribes should not meet with trouble, but there are, nevertheless, a few precautions which it would pay him to observe most carefully.

The personnel of the expedition should always include one or two trustworthy "boys" belonging to a tribe other than that to be visited. The mistrust these boys have in the "wild blackfellows", mingled with the fear of aggression, is in itself a guarantee of their watchfulness in times of necessity. For purposes of interpretation or guidance, an extra man can always be temporarily attached to the party when the occasion arises.

The camp-site should never be selected immediately adjoining a waterhole which is frequented by the natives of the district, especially in the more arid regions of Australia where great distances lie between the natural water-supplies. The camp should be at least from three to four hundred feet away from the water, in order that the rightful owners of the fluid may have easy and undisturbed access.

The livestock of the expedition (camels, horses, donkeys, etc.) should not be allowed to pollute the water; the native does not mind the animals drinking, but strongly objects to filth being deposited in his supplies, especially when they are limited. It is to avoid such contamination that he often sinks a soakage-well near to the edge of a waterhole, which he then covers with sticks and branches to keep out the indigenous animals and birds. For similar reasons,

members of an expedition should not be allowed to bathe in small waterholes upon which the natives are dependent for their supplies.

It is a bad policy to permit the natives to come into the white man's camp and take stock of the stores and equipment. They quite understand the idea of privacy, and never attempt to trespass on the camping ground of a visiting tribe, much less on that of a party of Europeans, unless encouraged to do so.

A camp should never be left in charge of one man only. Trouble has repeatedly been experienced by prospecting and other parties who left their headquarters, with only the cook to look after their property during their absence. The cook of an expedition is a busy man, and soon becomes wholly absorbed in his culinary duties; he can not be accused of neglect, therefore, if at any time he is surrounded by a body of native warriors who take advantage of his defenceless position. Any man who undertakes to guard a camp should never neglect to carry a firearm on his belt and keep a watchful eye on the surroundings. With this object in view, a camp site should, if possible, be selected on more or less open and level ground.

When there is suspicion of an unfriendly reception by the natives, which may result in molestation, it is advisable to keep a close watch over the animals attached to the caravan. If *en route*, a camp should be selected not later than mid-afternoon. and the animals hobbled out immediately. At night-fall all livestock should be "rounded up" and brought back to the camp again. Horses and leading donkeys should be short-hobbled. Neck-bells should not be forgotten,

since they are not only of use to locate the animals in the morning, but their tinkling also gives the alarm if the animals are harassed by the natives.

Camels should be brought in before dark, placed at intervals in a complete circle around the camp, and tied by the nose-line to bushes or stakes. By this method the animals automatically act as a reliable sentry, because, if any stranger draws near to, or tries to pass through, their line, they immediately become restive and disturb the peace of night.

On rare occasions it may be found necessary for the men to take their turn at watching. Although cases of midnight attacks have been recorded, the usual time a native chooses for mischief is about, or immediately before, dawn.

If at any time a number of natives are observed hovering silently about the camp, endeavouring to hide behind bushes, rocks, etc., it is well to keep on the alert. An aboriginal who wishes to approach in a friendly way and parley with a stranger, almost invariably shouts from afar and gesticulates with his arms. It is advisable to walk towards him and imitate his actions.

An European should never betray any sign of timidity when advancing, but, nevertheless, should not omit to carry a revolver on his belt. As he draws near to the native, a careful glance should suffice to convince him that the fellow is not holding a spear between his toes and trailing it through the grass.

As further proof of his friendliness, the native will, in all probability, now be observed to be carrying a green twig in one of his hands, which presently he will

lift towards the newcomer. The white man should follow his example.

If there is a group or family lurking in the neighbourhood, more than one of the men will approach in this way, and in many cases they will push a child ahead of them, whose innocence is offered as a plea for peace.

By the time the European arrives, the native, or group of natives, will very likely be sitting on the ground, with downcast eyes. When spoken to, they will stand up and, whilst replying in a low tone, walk towards the white man, whom they pat on the chest. This act is intended as a compliment and should be returned. Friendship is now established. In all probability, more members of the tribe will arrive soon after.

Very often the old men present will select one or two young women whom they offer as a token of their hospitality to the stranger. The white man's refusal to accept these is not regarded as an insult, provided presentations are made to the old men in return for the courtesy. A liberal distribution of useful articles should be made among the group, great care being exercised not to neglect the old men. Among the numerous articles which are appreciated by aborigines might be mentioned: matches, tobacco, pipes, pocket-knives, coloured handkerchiefs, bead-necklaces, boiled sweets, biscuits, etc.

A gift which is prized more than anything else is a tomahawk, but it must be remembered that such may become a dangerous weapon in the hands of one so dexterous as the Australian aboriginal. There are mo-

ments when an irresistible desire may overcome the unstable mind of a savage to use the lethal plaything, even against the donor himself.

For the same reason it is not always safe for a white man to walk immediately in front of, or stand with his back towards, an unsophisticated aboriginal.

In any dealings with an aboriginal, a white man should be firm but considerate, fulfil all promises he may make (whether they be in the native's favour or otherwise), and at all times act in a superior and masterly way. If the visitor can find an opportunity to impress the natives, he goes a long way towards establishing a reputation. Marksmanship and small surgical operations are two of the surest ways of winning a tribe's favour. The inherited dignity which is common to all natives of Australia, debars them from being cowed, even by brute force; on the other hand, if a person proves himself too frivolous or frolicsome, the natives soon lose their respect for him.

The above are some of the rules which I have successfully employed during a term of some twenty years of travel among the indigenous inhabitants of Australia; they, indeed, embody the golden rules of experience observed by all bushmen. Committed to print, these instructions seem, perhaps, a little stretched; nevertheless, if the principles underlying them be observed, the scientific investigator should not have much difficulty in handling any of the primitive tribes he wishes to study.

As regards the best system of investigation to be employed, it is not for me to make any suggestions; every trained anthropologist prefers to apply his own

favourite method. It is, of course, of very great advantage to acquire an insight into the dialect, if possible, before visiting any particular tribe. Even if a vocabulary of the actual tribe to be visited is not available, it should be remembered that nearly every native one meets has a very fair knowledge of one or two of the adjoining tribal dialects. The information and knowledge obtained by "overhearing" a conversation is of much greater value than any matter extracted by direct examination. In any case, the investigator should not put his questions too pointedly lest the aboriginal become suspicious and give evasive, misleading, or wrong answers.

In the event of a scientist not being able to acquaint himself with the language beforehand, he will find it of considerable advantage to take an interpreter with him. Nowadays, one may expect also to find, even among the remote tribes, several members who can master a few words of 'pidgin-English'.

For information concerning the more important affairs of the tribe, organizations, initiation ceremonies, religious beliefs, magic, and traditions, the old men should be consulted.

The pronunciation of ordinary words is best obtained from the women and children, preferably in the presence of two or three elders to check the sounds.

Great care should be exercised in drawing conclusions from direct and important leading questions; and the complications arising from the use of negative interrogatives should be avoided. Practically all the tribes confirm a negative interrogative by affirmation. Let us take a simple case. To a question such as:

"Your tribe does not allow this marriage to take place, does it?"; the answer would in all probability be "Yes", when in our own language the intended meaning would be conveyed by "No".

Frequent corroboration should be sought upon matters of vital concern. The aboriginal's intuition is marked; and he soon discovers in which direction his answers please the enquirer most. For the mere sake of granting this pleasure, especially when a reward has been promised him for supplying the information, he will often fabricate his story as the enquiry advances.

Much patience, and still more tact, will have to be exercised when facts pertaining to delicate and secret questions are required. Even under favourable conditions of enquiry, the old men are loth to supply information of this nature to a stranger. Much will depend upon the mood of the native at the time of the enquiry.

At any time it is inadvisable to exhaust the patience of a man under examination, because, once his good nature is ruffled, he will throw back anything that happens to come to his mind, even abuse.

8. HINTS FOR BOTANICAL TRAVELLERS

A. IN EASTERN AUSTRALIA

BY

R. H. CAMBAGE

a. *Collecting*

The simplest method of collecting is to place the specimens in a press and thereby keep them flat. The

press may be made of two thin flat pieces of light wood, say, eleven to thirteen inches wide, by sixteen to eighteen inches long, the larger size is preferred if much collecting is to be done. The wood need not be in one piece but made up of three or four separated strips held together with two crosspieces bolted on. The press may also be made of wire of about 16 gauge, with a mesh of two inches, held together with an iron band or rim of about three quarters of an inch wide. Eyelet holes may be placed on each half of the press to hold in position two straps or cords which are fastened around the whole.

In a dry climate, like that of Australia for the most part in the spring and summer months, collecting plant specimens in tins is not advocated, as this method often allows the leaves to curl up, and placing them early in the press gives ultimately the greatest satisfaction.

Sheets of coarse blotting paper may be used, especially for delicate specimens, but for most plants ordinary newspaper is quite satisfactory, especially in dry weather. After about the first three days the papers should be renewed, and at longer intervals later during a period of about three weeks. It is often of great advantage to loosen the straps and allow the air to pass through the press.

During the rainy season in tropical Australia, about January to April, greater care has to be exercised in drying specimens, and also in the sub-alpine regions of the mainland and parts of Tasmania.

For the purpose of saving ripe fruits it is desirable to be provided with envelopes, which open at one end,

from five to six inches long, and nearly three to three and a quarter inches wide.

b. *Regions*

Queensland. The east coast of North Queensland is a good centre for collecting tropical jungle plants, and Cairns is a suitable spot from which to reach the hinterland towards the gulf of Carpentaria, where the endemic xerophytic vegetation is growing. A great portion of the journey to the west, upwards of 350 miles, may be made by train, while the rest is covered by service vehicles which run regularly.

From Townsville on the coast a journey may be made inland by train through Hughenden to Cloncurry a distance of 480 miles, and similar journeys from Rockhampton and Brisbane to Longreach and Charleville, the respective distances by train being 428 and 483 miles. From these terminal points, which are all in the interior, and surrounded by xerophytic vegetation, arrangements may easily be made to visit many localities even further inland, where settlers are established.

New South Wales. From Sydney, radial train lines may be taken along the north and south coasts and to the Blue Mountains, 60 to 70 miles, at an elevation of 3500 feet, and on to Bourke at about 500 miles on the Darling River in the interior; also southerly to Canberra, about 200 miles, (at an elevation of 2000 to 6200 feet) and Cooma, 268 miles. From the latter place Mount Kosciusko may be reached by motor in 50

miles, and this is the highest point in Australia, 7328 feet. Here the sub-alpine flora may be collected towards the summit in December.

Victoria. From Melbourne, the Gippsland country to the eastward, can be reached by train, and here may be seen some of the giant Eucalypts of Australia, while to the westward, the railway penetrates the interior vegetation, especially towards the north-west.

Tasmania. From Hobart and Launceston the sub-alpine vegetation may be reached by excursions as may be arranged, about November and December.

Local Information. In each State local information may be obtained from the various Government botanists in regard to plant distribution, while the local Lands Department and Tourist Bureau will supply maps and useful information concerning routes.

B. In the Arid parts of Australia

BY

MARJORIE J. SHIELS

Botanists wishing to make a collection of plants in the desert or arid parts of Australia, should arrange to visit these parts during the growing season from July to October. Not only will more flowering specimens be collected during this period, but the traveller, if unaccustomed to hot, dry climates, will find the weather more suitable for outdoor work.

It must be understood, however, that in times of drought, one may collect a very poor flora even in these months of the year, and may see practically nothing of the rich ground flora of annuals and ephemerals, which usually carpet the ground after a normal rainfall.

Again, in those parts of arid Australia characterised by a uniform seasonal distribution of rainfall, the collector should pay a second visit to the region selected for investigation during the autumn months (March to May) as a distinct summer-rain flora will be present at this time.

Routes. A botanist arriving in West Australia, would do well to leave the ship at Fremantle and travel overland by rail to Adelaide, thus traversing the famous Nullarbor Plain with its fine example of saltbush association (*Atriplex vesicarium*).

Adelaide might be considered to be the best starting point for a botanical expedition to the desert and arid portions of Australia, as it is possible to reach several interesting collecting fields by rail from that city. Also the botanical collections of several scientific expeditions into Central Australia and other arid parts, notably those of the Horn and Elder Expeditions, are housed in the Tate Herbarium, University of Adelaide, and may be examined.

A comparatively short journey may be made by rail from Adelaide to Morgan (average annual rainfall 10 inches, distant 100 miles) where typical saltbush country may be explored. Longer journeys may be made to Broken Hill in Western N. S. W. (Average

annual rainfall 9 inches, Distant 300 miles) or to Oodnadatta (average annual rainfall 5 inches. Distant 700 miles).

Accommodation. As a large proportion of country in arid Australia is given up to the pastoral industry, it would be well for the botanist to communicate with leading pastoralists of the particular region to be investigated. As a general rule the hospitality of sheep and cattle stations is offered to visitors engaged in literary or scientific work, and every facility is given for the furtherance of the investigation. In the ordinary routine of an Australian sheep station, the owner or manager must make almost daily journeys, by car or on horse back, to some portion of his "run". The botanist may at the same time carry out collecting or photographic work in the company of one who is usually a keen and accurate observer, and is a mine of useful and interesting information on the country.

The writer would advise intending visitors to communicate with Sir Sidney Kidman, a pastoralist with large holdings in the desert and arid portions of Australia, before leaving Adelaide.

Maps and other information may be obtained at the Lands' Departments in the capital cities of the various states.

Clothing. The most suitable clothing for botanical collecting in arid Australia is made of a light weight, khaki coloured drill. Khaki riding breeches, tunic and shirts and a woollen sweater are suitable for both men and women. Leggings or puttees are useful as a

protection against snakes, ants or prickly shrubs.

The ideal headwear for arid Australia is a khaki coloured cork helmet provided with air holes around the crown. If the visit is to be extended into the summer months, smoked glasses and a fly-veil should prove very useful.

The clothing described above is suitable for work in the field in any part of Australia. A heavier woollen sweater of cardigan is needed in the alpine region of Mt. Kosciusko and in Tasmania. Heavy nailed boots are only necessary in alpine parts, and not in the interior.

Collecting. For herbarium material specimens should be placed directly in a light field press of card-board and transferred to a heavier press on returning to headquarters in the evening. Newspapers are often sufficient for drying sclerophyllous plants, but as a general rule blotting paper is used extensively in Australia, the plants being first placed in folders of newspaper. Half a ream of blotting paper may be obtained (240 sheets) for about 25 shillings. Newspapers may be cut to herbarium size on a printer's guillotine, for about one shilling and sixpence for 10 to 15 lbs. The Daily Guardian, a Sydney paper, is almost herbarium size.

For preserving material in spirit, 70 % alcohol gives good results for fixing plants in the field. If large quantities are needed, this should be obtained through the courtesy of the University Botany Departments, or a special permit must be obtained before a purchase can be made.

Photographic Material. This may be obtained in all Australian cities but it is not advisable to trust to small country stores for supplies. Films and plates are apt to blister during the intense heat of summer in arid Australia.

N. B. It is important to note that collectors from other countries are expected to place duplicate specimens of all new genera, species or varieties collected in Australia in the National Herbarium of the State in which the collection is made.

SCIENTIFIC TRAVEL IN ANTARCTICA

BY

GRIFFITH TAYLOR D. SC., B. E., B. A., F. R. G. S.
Leader of the Western Parties and Senior Geologist in Captain Scott's Last Expedition
Professor of Geography, University of Sydney

SCIENTIFIC TRAVEL IN ANTARCTICA

BY

GRIFFITH TAYLOR

Introduction. Antarctica is a huge continent probably containing some $3\frac{1}{2}$ million square miles, so that it is obviously impossible to deal in any but a very general fashion with scientific travel therein [1]). However, the experience of the writer was gained in what is generally allowed to be the most interesting region of Antarctica, that territory surrounding MacMurdo Sound, in 78° S. latitude and near longitude 164° E. of Greenwich. Here all varietiesof the Antarctic environment exist. To the west is the great inland plateau, here about 8000 feet high. To the south is the surface of the great Ross Ice Barrier, a thick sheet of floating ice near sea level but several hundred miles across. At the back of winter quarters towered the volcano of Mount Erebus, some 13,000 feet high and still active. Chief of all, however, was the presence of relatively large areas of lowlands practically free from ice or snow, which were happy hunting grounds for the geologist, glaciologist and biologist, while even the botanist could occasionally find speci-

[1]) *Griffith Taylor.* With Scott. The silver lining. London, 1916.

mens of a land flora. Two of these bare areas, explored by the writer's party in 1911—12, were some 25 miles

Fig. 1. The writer's journeys around MacMurdo Sound (from the Geogr. Journal, July, 1913).

long and 2 or 3 miles wide (see Fig. 1.)

Climate. As one proceeds towards the Pole the season suitable for sledging becomes shorter and shorter, since only under exceptional circumstances can sledg-

The whaler Terra Nova off Cape Evans.
January, 1911. Photo G. Taylor.

ing be done in the long polar nights. In the north the presence of a relatively warm ocean, somewhere about + 30° F. makes the Artctic winters much less severe than those of the Antarctic. The southern continent consists of a gigantic plateau, largely over 8000 feet high, which acts as a 'cold storage' reservoir having an effect exactly opposite to the warm waters of the Arctic areas. This is clearly shown in figure 1. taken from Simpson's Memoir of Antarctic Meteorology, 1919. Hence two great climatic factors operate against winter exploration, the intense cold (dropping to — 77° F. at times), and worse still in the area specified, the furious and almost continuous blizzards from the south and southeast.

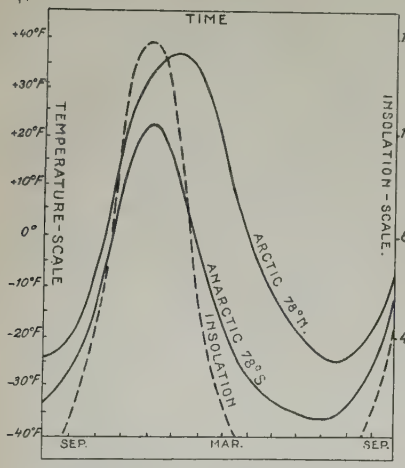


FIG. 2. The average monthly temperatures in 78° of latitude in the Antarctic and Arctic regions. Also the variation in solar energy. (After G. C. Simpson).

Active work in the Antarctic is best confined therefore to the period September to March inclusive, and even the early part of September and end of March are very bitter periods for outdoor work in 78° S. latitude (see Fig. 2.)

The continent in this region south of Australia is

fringed by a belt of Pack Ice which breaks away early in the summer. Hence most vessels leave Australia or New Zealand toward the end of November and thus reach the breaking pack ice early in December. In 1910 the "Terra Nova" spent three weeks breaking through 500 miles of pack ice, and so only reached Ross Island on January 4th. This ,however, was an unusually difficult voyage. Other vessels have traversed the ice in a week, and so reached the continent a fortnight earlier.

The mean wind velocity in miles per hour at Cape Evans, Ross Island, is given in the following table (after G. C. Simpson) for the two years 1911 and 1912.

	1911	1912
January	12.5	10.9
February	22.7	20.5
March	25.6	24.8
April	15.9	20.2
May	12.0	25.0
June	13.2	31.8
July	18.5	28.8
August	16.7	25.3
September	14.5	22.5
October	17.9	17.3
November	16.1	18.9
December	14.7	11.1
Average	16.7	21.4

In Adelie Land, to the west, just on the Antarctic Circle, Mawson recorded 50 miles an hour as the average *annual* wind velocity (most places in U.S.A. have an average annual wind velocity of under 11 miles per hour).

The Ship. A few details based on the lengthy account given in the "Miscellaneous Data" (H. G. Lyons) publication of the British Antarctic Expedition, 1910—13, will probably be useful.

As usual the ship used was a wooden whaling vessel. She was barque-rigged and had a registered tonnage of 400 tons. At bow and stern she was reinforced with seven feet of oaken timber to withstand the pressure of the ice-pack. She was fitted with auxiliary engines of 140 horse power which actuated a four-bladed cast steel propellor. Coal was used as fuel, largely in the form of patent "bricks".

A good deal of scientific work was carried on during the voyage to Antarctica, and one biologist remained permanently on board carrying out research in southern seas, while the land parties were in Antarctica. It was found possible to build a block of four small laboratories on the poop deck along the port side. These four filled a space 18 feet long and 5 feet wide; and there were three allotted to scientists engaged on physical and biological work. The largest was occupied by the official photographer.

Ponies. On the first voyage 19 ponies from N. E. Siberia were carried on the ship. The top-gallant forecastle was converted into stables. Each stall was 2 feet 8 inches broad with portable partitions between. On the second voyage south seven Indian mules were carried. They were placed in stalls on the deck, and the stables were covered with painted canvas.

Dogs. These were fastened amid the deck cargo on

the voyage south, but on the return wooden trays were made for them to lie upon. They were 2 feet broad and raised 3 inches off the deck, and were a great advantage in hot or wet weather.

The following notes (read before the Field Naturalists' Club of Victoria) give an impression of the scientific activities on the voyage to the South.

On the voyage — which occupied five weeks — the biologists were perhaps the busiest scientists. But the study of the bergs and floe ice, together with the sounding work, gave the geologists much to do. The bergs were driven by the blizzards farther north than the floe ice. They were usually huge tabular sheets torn off from the Great Barrier; but irregular or pinnacled were not uncommon, and these were derived partly from glacier snouts and partly from disintegrated barrier bergs. One of the most interesting was about a mile long, and had originally been tabular. All along the face were enormous vertical joints, broadening into seacaves below. These had split the berg into columns, so that it was wonderful how it held together; but probably the portion under water had not been eroded by the waves, and still remained fairly solid. At each end was an isolated pillar, a hundred feet away from the main mass, and over a hundred feet high. It exactly resembled the classic geological example of weathering known as "The Old Man of Hoy."

We were imprisoned in pack ice for nearly three weeks, and here made acquaintance with some of the characteristic Antarctic fauna. Snow-Petrels and other sea-birds flew around the rigging, and were occasion-

ally caught by Wilson and Cherry-Garrard in loose snares. Others were shot and retrieved in the dinghy. It was queer work navigating the floes. Many were too slushy to stand on and yet too solid to admit of the boat's passage, so that some of our specimens were perforce abandoned. A few crab-eater seals were shot, and we found it a laborious job to get their heavy, unmanageable carcases aboard. They live on small crustacea chiefly, and their ferocious-looking fanged teeth act only as sifters to free the shrimps from the water; they are, therefore, in function, akin to the whale's baleen. Wilson set up a "flensing" table on which to lay the skins and carve off the thick layer of blubber which lies just beneath. The hides were rubbed with salt and rolled up for transport. The skeletons, I believe, were roughly cleaned, then dried, and carried quite satisfactorily until they reached the museums.

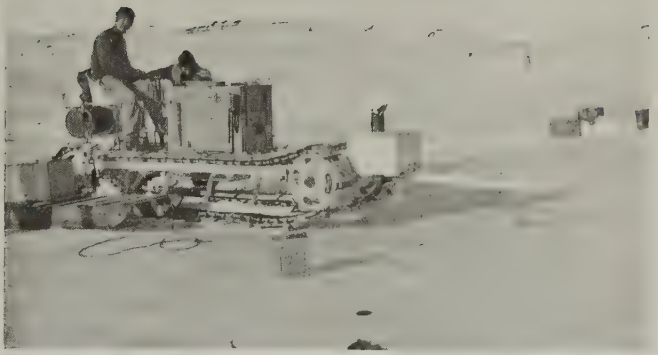
Nelson and Lillie were busy getting deep sea temperatures by a very ingenious reversing cylinder. This was sunk at the end of miles of piano-wire, and samples of the bottom were also obtained on these lines. Forams and volcanic lava thus obtained were of interest to the geologist; but our queerest collection was a set of specimens from the gizzard of an Adelie Penguin. There were three rock-types represented in this collector's gallery, and only ten years or so before they would have doubled our knowledge of Antarctic petrology!

Microscopic life swarms in these Polar seas. It is stated that there is almost as much protoplasm per acre of ocean as there is in a well-cultivated land crop. Most of this occurs as diatoms and infusoria, forams,

and copepods; indeed, almost every floe in its lower layers is stained yellow from the presence of millions of small diatoms allied to *Corethron*.

Early in the new year of 1911 we cruised along the slopes of Mount Erebus. On shore we could see the rookery of the Emperor Penguins, where Wilson's party nearly lost their lives in midwinter, 1911. It was now nearly empty—for this misguided bird lays its eggs in the middle of the long night. A little to the west was one of the largest Adelie Penguin rookeries. Here the rocks were brown with guano, while the seas teemed with shrimps (*Euphausia*), which formed the food of the innumerable penguins. Along the edge of their territory prowled the killer whales (*Orca gladiator*). I should think the latter animal is as dominant in the southern seas as man is on the land; and when (as happened on three occasions) there was a tussle between men and Orcas on the floating ice, it was the Orcas who gained a strategic victory!

Headquarters. Most expeditions have carried timber to the Antarctic and there built a substantial hut. There are now three such huts on the eastern shore of MacMurdo Sound. The 1911 hut was about 36 feet wide by 60 feet long. It was built along the NE.—SW. axis, and the stables were in the form of an annex on the sheltered NW.-side of the hut. A rough verandah built up of food cases, etc., flanked it on the windward side. A double door led into a small porch in which the acetylene generator was placed, so as to keep it away from the stoves, etc. Another door opened into the SW. third of the hut. This was the crew's quarters and



A pioneer in caterpillar traction. The motor sledges used on the Great Barrier by Scott in 1911.

Photo G. Taylor.

Mount Erebus, Antarctica, showing Cape Evans at the extreme left. 1 1/2 miles of the long glacier tongue on the right (broke off in March, 1911).

Photo G. Taylor.

was separated off by a bulkhead of store-cases from the further and larger part of the hut in which the officers dwelt. In the crew's section was the galley and a large Singer sewing machine, used for tentmaking and for harness repairs, etc.

A small iron bedstead was supplied for each man. These were usually arranged in pairs, one above the other, to economise space. The nine sailors slept in corners of their quarters but the officers had six small 'cubicles' which were partitioned off, and enabled the various groups to keep their books, gear and apparatus in order. Thus the geologists had one cubicle, lit by an acetylene jet, with a small table on which stood a microscope. Quite good petrological sections were made with primitive apparatus in this cubicle. In the next cubicle were the biologists. In the corner cubicle were the physicists. Alongside was a darkroom (6 feet by 8 feet), in which the photographer worked and slept. In the next corner was the draughtsman's table, while Captain Scott had a small cubicle to himself. A small stove warmed this end of the hut, while a large table extended down the middle of the officers' quarters and was usually covered with maps, diaries and calculations except at mealtimes.

A great deal of scientific work was carried out at headquarters notably in the realms of Meteorology and Magnetism.

These are briefly epitomised in the following abstract from the article quoted previously.

During the long winter night, Captain Scott instituted a series of forty lectures. These were given, not only by the scientists on all branches of science, but

also by Ponting (our camera artist), and by most of the naval officers, on such subjects as travel, clothing, food, surveying, &c. Much time was spent in writing up records of the past summer's sledging, and also in preparing for the ensuing season; but the vicinity of the hut offered many problems of its own. There were great cones of *débris*, up to thirty feet high, which we found to be due to the complete weathering of huge monoliths of kenyte lava. The biologist kept a pool open in the sea ice right through the winter. Here, protected partly by a six-foot wall of ice from the furious blizzards, he dredged and took temperatures. To prevent the delicate organisms from getting frost-bitten, he used to carry them the mile to the hut in a thermos flask! Nearer the hut we had fishing-holes, in which we sunk a wire fish-trap. Many weary half-hours have I spent hauling this contraption up at temperatures down to eighty below freezing! All the fish were *Notothenia*, about eight inches long. Even forty of these (our greatest catch) did not go far among twenty-five stalwart explorers.

In ice-grottos carved out of the living glacier were stationed the magnetographs and the pendulums. Here Simpson and Wright would engage in a "quick run." At this instant all over the earth similar magnetic records were being taken with a view to correlating them with auroræ, sun-spots, magnetic storms, etc.

Sounding balloons were sent up to chart the upper air. They carried meteorographs, which recorded temperature, pressure, and humidity, and also a fine silk thread, which, like Penelope's web, was supposed to

lead one to the fallen treasure; but either the thread had snapped on an icy pinnacle or else the instrument had drifted over the open water or other accident had supervened. Few of us claimed the chocolate allotted to the successful tracker, but Simpson obtained sufficient records to add greatly to our knowledge of Antarctic aerology.

Lieutenants Evans and Gran spent the spring months in a theodolite survey of the whole vicinity. Debenham and I plane-tabled Cape Evans—one of the coldest jobs I have ever tackled. One could hardly draw accurate lines muffled up as comfort required; and with temperatures of — 40° thin gloves soon meant torture.

Through the sleeping hours the night-watchman (*i.e.*, each of the officers in rotation) kept watch in and around the hut. He would cast an eye to the east and see a glow over the crater of Erebus. To the south and east the dancing curtains of the Aurora often flashed across the sky. Usually they were grey or palest green, and were never so vivid as they appear in more northern regions. In foul weather, which occurred five days in the week, it would often be his unpleasant duty to free the Dines' pressure-anemometer ("blizzometer") from the blizzard snow. Picture him muffled up and carrying an electric torch round the hut to the base of a frozen ladder. Up this he creeps in the teeth of a gale at seventy miles an hour. Sheets of snow drive past him into the bay, and seem to rock the roof across which he straddles. Here projects the tube of the "blizzometer", and it is his unpleasant duty to excavate the snow therein until the tube is clear and the

"blizzometer" registering again. He returns to the shelter of the hut, knowing that it will probably be his lot to repeat the performance before his watch is over. So passed the long night.

Sledging Operations. Life at headquarters during the six months of darkness was not widely different from the conditions obtaining in a primitive environment almost anywhere. But sledging involved a very unfamiliar set of operations.

In the first place there are two quite dissimilar fields for exploration in the Antarctic. There is the coastal survey and the inland survey. In the latter case vast uniform fields of ice are traversed, with very little chance of work at anything geological or biological. The journeys toward the Pole have been of this type, and each is inevitably a race against time and hunger. In most expeditions it has been realised that the scientific staff will be better employed on coastal surveys. This at any rate is the type of region with which the present writer is familiar, and he will confine his remarks to the coastal regions only.

Personnel. The great majority of separate parties have consisted of three or four members. Two men are quite insufficient in crevassed country. Four men can often do much more work, for they can tackle different quarters in two parties of two each, whereas a single man is at a great disadvantage, if an accident occurs, even if only a few miles from the tent. Moreover sledging gear for four men is not much bulkier than for three. It may be that the writer is prejudiced

Establishing headquarters at Cape Evans, Antarctica, in January, 1911. Notice the hut and stores. In the background the volcano of Erebus, 13000 ft.

Photo G. Taylor.

North Bay, Cape Evans, showing the ship in open water, one mile of floating ice. The fixed ice-foot (between the man and land) and the lava slopes of Mount Erebus.

Photo G. Taylor.

by his training, but he thinks that coastal parties should consist essentially of geologists, who must be capable of using theodolite and plane-table. The refined knowledge of an expert navigator or surveyor is wasted in such a journey, where only the lunch hour or evening is available for a hurried 'round of angles'. The recognition of topographic forms should be a specialty of modern geologists, if they have had an adequate physiographic training, and this is more probably found in the geologist than in the naval officer or professional surveyor.

It is unnecessary to point out that a biologist, whether botanist or zoologist, would be wasted on such a journey. Most geologists, however, have studied some botany and zoology, and are capable of collecting such mosses and lichens, etc., as they may come across, and with a little advice can make useful notes on the types and habits of the fauna encountered.

(I am not here referring to the Plateau or Inland journeys, where the main essentials in a explorer are a knowledge of navigation on trackless plains, such as naval men obviously possess to a high degree, coupled with indomitable pluck and endurance, in which they also have an unrivalled record).

Too little stress has been laid in many expeditions on ability to take successful photographs and to make numerous sketches. The latter is all-important. With practice quite valuable sketches can be made in a quarter of an hour, which are far ahead of any verbal description. Outside of these qualifications nothing is so essential as a cheery temperament. It is worth more than strong biceps, for the latter develop en route,

while humour has a tendency to become diluted after four months' stiff sledging. Certainly the latter is not an ideal environment for its birth and growth.

Sledging Equipment. A man can drag about 200 lbs. on the ordinary type of Antarctic sledge. For a sledging journey of six weeks, a party of four men will need about 350 lbs. of food (two pounds per man per day). The following list gives the chief details of the equipment used on my first sledging party to the Western Mountains.

Sledges, etc.	lbs.
Twelve-foot sledge	52
Nine-foot sledge	47
Two instrument boxes	14
Iron under-runners	52
Total	165
Food, Fuel, etc.	
Oil tins on platform	98
One tin of spirits	5.5
Seven weeks' food	250
Biscuits (four boxes)	196
Ready bag (one week)	41
Boxes protecting biscuit	52
Cooker	7.5
Total	630
Tools, etc.	
Three ice axes	8.5
Crowbar and shovel	14
Candles	3
Lantern	1.5
Total	27

	lbs.
Alpine rope	11
Bamboos	2.2
Tent and poles	26
Four sleeping bags	49
Repair bag, etc.	14
Total	102
Instruments,etc.	
Theodolite	11½
Aneroids, etc.	1
Zeiss camera	8
Six dozen plates	12
Goerz camera	7
Three dozen plates	6
Box camera and films	7
Polariscope	5
Binoculars	3
Compass, Abney, etc.	5
Total	65
Personal gear	50

Totals

Sledges, etc.	165	
Food, etc.	630	
Tools, etc.	130	
Instruments,etc.	65	
Personal	50	
	1040	lbs.

Sledges. We used the Nansen type of sledge made of tough wood lashed by hide. This is fairly flexible with runners giving a moderate bearing surface. The whole

sledging problem in my experience hinged on the character of the ground traversed. My colleague Wright has given a lengthy study of this matter in the official memoir which I quote here.

> "The best surface is bare ice (free from salt) and "somewhat rippled. Hard wind blown snow is "good. Freshly fallen snow is bad for sledging. "Fresh sea-ice with brine on the surface is almost "impassable with a fair load. Wright suggests "that for new-fallen snow it would be well to have "a curved metal shield (concave downward) under "the sledge body, so that as the runners sank "in the snow, the shield would rest on more and "more snow, and so support the weight. It seems "possible that the friction increased as the tem- "perature fell below about 30° F. though melting "snow was of course difficult to traverse."

We carried long *iron* under-runners on the first journey which were to be attached under the wood on splintery ice surfaces, but we found them quite useless, and indeed, dangerous, on land-ice. However, they were found very valuable by the northern party on sticky sea-ice, to which wooden runners adhere like glue.

I am sure that a dog team would have enabled us to do twice as much work while along the coast. They could, I feel sure, be left tethered at the coast for a week for a week or so, while inland journeys were made, with some provision of seal meat. Probably they would eat all the food in the first few days, but in the warmer summer months they have been known to exist without food for many days after such a gorge.

Seals are very abundant in December, January and February. For instance, in New Harbour we saw two herds totalling about a hundred individuals.

Dog-sledging. In our expedition the dogs were obtained from the Amur River in east Siberia. A full team consisted of 13 dogs, six pairs being harnessed to a trace opposite each other, while the leader was on a long line at the end of the trace. The average weight of a dog was about 70 lbs. They were fed at first on Spratt's biscuit, $1\frac{1}{2}$ lbs per dog per day. But later a rough pemmican made of seal meat and blubber, was fed to them on which they throve.

A dog was supposed to pull 95 lbs. A team could do about 11 miles a day, but needed several days' rest after a trip of a few days. Two Eskimo dogs in the expedition were much hardier and they throve where the Siberian dogs were getting thin and dispirited.

Pony-sledging. A few notes will be of interest though the writer had little experience himself. Our ponies were obtained from Vladivostock and were 14—15 hands high. They were all white or grey in colour. They were watered and fed three times daily. The daily ration consisted of 2 lbs of oats and $1\frac{1}{2}$ lbs of oil cake with about 11 lbs of chopped maize. Each pony pulled from 500 to 600 lbs, and each pulled a sledge and was led by a driver who walked alongside. They marched about 11 miles a day, taking seven hours over the journey. On camping, walls of snow-blocks were built on the windward side. Their bodies were covered with canvas during the halts. Special measures were taken

to prevent snow-blindness and to prevent them from sinking into soft snow which are described in the official memoirs.

No dogs or ponies were available for coastal journeys, and it is doubtful if the latter would be of much use under the conditions of a scientific coastal survey.

Sledging Food. When sledging on long journeys, three meals were eaten each day, breakfast, lunch and supper. The daily ration consisted of biscuits, pemmican, butter (or cheese), chocolate, sugar, cocoa, tea and at times, raisins. In the following list are given the details for a lengthy journey of 20 weeks.

Food for 4 men for 20 weeks

	per week		Total		
Biscuit	24.5	lbs =	490	lbs	(Huntley & Palmer)
Pemmican	10.5	" =	210	,,	(Beauvais)
Butter	3.5	,, =	70	,,	
Sugar	7.0	,, =	140	,,	(Tale's)
Chocolate	4.6	,, =	92	,,	
Cocoa	1.5	,, =	30	,,	
Whole-meal	2.5	,, =	50	,,	(Colman's)
Raisins	1.5	,, =	30	,,	
Tea	.88	,, =	17.5	,,	(Cooper's)
Salt		,, =	8.75	,,	

For the "hoosh": Pepper, 2 small bags. Curry powder, 1 bag. Cooking fat, 2 bags (25 lbs). Pea flour, 3 bags. Onion powder, 1 bag.

Allowance per man per day

Biscuit	14	oz. (7 biscuits)
Pemmican	6	„
Butter	2	„
Sugar	4	„ (20 lumps der day)
Chocolate	2.86	„ (2 sticks)
Cocoa	.86	„ (2 meals at 3 spoons each)
Wheat meal	1.43	„
Raisins	.86	„ (1 spoonful)
Tea	.57	„

(*Matches*, 1 box per week. *Toilet-paper* 6 packets in all.)

The regular ration of pemmican, biscuits and butter was grand, and suited all our party. Chocolate, some flour for "thickers", sugar, tea and cocoa cannot be surpassed as the less important staples. I should be inclined to issue a regular ration of simple condiments or flavourings, especially if the party is going to live largely on seal meat. Onion powder was worth its weight in gold, for we became very tired of seal meat after several months. The latter is practically tasteless (if it is not fishy), but with onion powder one did not need a strong imagination to conjure up "steak and onions". The meal is often the only comfort when sledging, and these condiments weigh so little that I think they might be issued.

Cooking Apparatus. The Primus stoves used on the expedition were manufactured by Hjorth of Sweden. They served us excellently, so much so that one prominent mountain near MacMurdo Sound is named

Mt. Hjorth. A number of prickers to clear the nipple and several spare nipples should be taken. A gallon of paraffin suffices for cooking three meals a day for a four man unit for a week or 10 days. The paraffin was carried in rectangular tins each holding one gallon and weighing 10 lbs. A small amount of methylated spirit was carried to start the primus. About 2 oz. per week was used [1]).

The cookers were of the usual type known as Nansen Cookers. They were made of aluminium and comprised an outer cooker of annular shape, which enclosed an inner cooker with a lid. The whole was placed over the Primus stove.

The procedure was for the cook's mate to chip off flakes of ice from the adjacent glacier, and roughly fill the outer annulus and inner cooker. This was passed into the tent where the cook placed it on the Primus. In about quarter of an hour the ice melted. The cook placed the lumps of pemmican in the inner cooker and brought it to the boil. "Thickers" of pea-flour, onion powder, cornflour, etc., were added in small amounts, if such were carried by the party. We often used to crush the extremely hard biscuits with the geological hammer in a specimen bag, and add them to the pemmican soup, which is usually known as "hoosh".

Four double aluminium cups, the lids fitting into the larger portion, were carried. The thick hoosh was served by the cook into the larger portion. Meanwhile the annular outer cooker had melted most of its ice. The water was transferred to the empty inner cooker

[1]) Based largely on the Memoir by Surgeon-Commander E. L. Atkinson.

and boiled to make the tea or cocoa. Our party preferred tea at the lunch halt and cocoa for breakfast and supper.

Seal Meat. Any party sledging along the coast can be certain of obtaining Weddell seals during the summer months. Our party was given only half rations of pemmican in view of this native supply. There is no difficulty in obtaining seal meat. The huge animals lie basking for weeks at a time in a favoured locality. At Cape Roberts we found three seals on our arrival, and killed them week by week, the survivors taking no notice of the butchering operations alongside. Our method was for one man to attract the seal's attention, usually by dancing in front of him, then the other walks cautiously up behind the seal and stuns him with a heavy blow on the nose with a geological hammer. The seal was then stabbed under the fore-flipper with a long dagger. The liver and the flesh along the 'undercut' were the choicest portions. We used to cook (partially) lumps of flesh and liver over the blubber stove, and then carry this food in a large paraffin-tin on the sledge. It was added to our hoosh and was nourishing though rather tasteless.

The Blubber Stove was worth its weight in gold. It was made of sheet iron, and was simply a rectangular box, 18 inches long and about 10 by 10 inches in cross section. A round hole (about 8 in. in diameter) was cut in the top. A chimney of sheet iron, about 3 in. in diameter was rivetted in one end, and was about 4 feet high; we found that this length was not essential as there was always sufficient wind to make about 18 inches of chimney act.

The only objection to our pattern was the door, which occupied the other end of the oven and was hinged at the top. It would have been better if the opening had been stiffened and the door also, so that it would shut readily even when the oven was warped and dinted.

More important still, there should have been a 'sill' at least one inch high to keep the blubber oil from all escaping from the floor of the oven. We took a grid to carry the 'fids' of blubber, and asbestos wicks, but they were unnecessary; the ashes from the burnt skin or bits of bone acted as a suitable burning surface. We never needed to 'render' the blubber, but fed it in its native state. This stove must be completely sheltered from strong winds, and we built a granite hut for its use. It cannot be used in the tent, for in spite of all precautions, it evolves the filthiest oily soot that ever disfigured scientific note-books.

Tents. Our party carried a tent made by Edgington of London. It was of the wigwam pattern and made of green Willesden material, strengthened at the top by a leather cap which fitted over the bamboo poles. There were six poles each about 9 feet long and made of male bamboo. There was a valance about 30 inches wide around the bottom of the tent. Upon this, slabs of snow could be placed, to hold the tent snug. There were no guy-ropes, and the heaviest blizzard merely made the tents tighter by packing more and more snow upon them.

The tent was entered by a sleeve-shaped door, which could be tied securely when not in use. The

floor covering consisted of a canvas sheet. We found it of great advantage to have the whole floor space covered by this canvas. There was a vent at the top of the tent, and in the peak of the tent we used to hang our frozen boots over the primus, so as to thaw them before we put them on after breakfast. A small, stiff clothes brush was very useful,to brush off snow before entering the tent. The great curse of sledging is this snow on the clothes, or even worse, the frozen perspiration inside the clothes.

I may here refer to other details on the list of the sledging load, not yet discussed. The *instrument-box* was made of three-ply wood and fitted across the rear of the sledge. On top of it was lashed the cooker. The primus was put in the instrument box. It contained also our cameras and the theodolite which I shall discuss later. *The oil* was carried on a tray just forward of the instrument box. *The food* was packed in bags of one week's supply. Thus as the cooks were changed weekly, his first duty was to get the bags of pemmican, cocoa, sugar, etc., out of the large canvas "tank" or hold-all in which they were carried. The biscuits were carried in the original sealed tins. On our first trip we kept the outer *wooden cases* also (to save breakage of the biscuits) but this was not worth doing in view of their weight of 52 lbs. The shovel was very useful for piling snow on the valance. The crowbar was used occasionally when the sledge capsized in the pinnacle ice, but was not essential. The alpine rope was very necessary in crevassed country. Here the leader pulls the sledge by this rope, which enables him to march 30 feet ahead of the others. He thus can dis-

cover hidden crevasses (usually by stepping into them) without risk to the sledge or other members. He is readily hauled up from the crevasse, in which the snow-bridge usually holds him to some extent.

Sleeping-bags. In our expedition these were one-man bags made of heavy reindeer fur. They were about seven feet long, with the entry-slit about three feet long down the front, so as to leave a 'hood' for the head. Two broad flaps could be tucked across the entry-slit, and tied with cords and toggles. In very cold weather the sailors used to lie on their stomachs with the entry-slit beneath them. It was not obvious to some of us why they did not suffocate.

In very cold weather after some days of sledging it would often take many hours after one entered the sleeping-bag for the ice in one's clothes to thaw sufficiently to allow one to become somewhat warm, and so to sleep. I believe that Stefansson's method of crawling into the reindeer-bag quite naked, has a good deal to recommend it. Stefansson also built snow-huts every night. These were much warmer than tents, and even if they took longer to construct at night, there was no tent to strike in the morning. He claimed that even in midwinter he was never cold. In spring sledging the writer was never warm!

A small tomahawk would be very useful for cutting up seal meat. We had none. Also one of Priestley's small ice-picks would be well worth carrying if there was the slightest risk of being abandoned, even for a month. The ice axes were not often used for their le-

Crossing pinnacle-ice on the Koettlitz Glacier. Two men steadying the sledge. Photo G. Taylor.

A camp on the sea-ice at the snout of the Ferrar Glacier. January, 1911. Photo G. Taylor.

gitimate purpose of chipping steps. They were certainly valuable as supports on the slippery glaciers, but should have been stronger, even if it added a few pounds to the load.

Personal Gear. Personal gear of about 10 lbs. each was allowed to each sledger. This was kept in a little bag inside one's sleeping-bag and served as a pillow. Tobacco and a few books were usually carried. The writer carried a little eider-down rug, as he had no use for tobacco. Poetry seemed the most portable and popular form of literature, for one had nothing else to read for 4 or 5 months. I carried a German grammar, and on another such journey would certainly choose a pocket atlas.

Note-Books. Plain good paper with linen-covered-cardboard backs, opening sideways, with a loop and pencil and rubber tied on with string. Take four thin books (8 × 5 or so) rather than one thick one.

For long panoramic sketches, fold down one inch of the right hand page and sketch over this fold, then the panorama can be sketched continuously and to scale on the next pair of pages, and so on.

An ordinary geological hammer of medium weight, a small cold chisel (wrapped in canvas to prevent it sticking in to you), and a stout ruck-sack are essential. A plentiful supply of cloth specimen-bags is necessary.

Instruments. The prismatic compass is almost useless for accurate work in the magnetic area. Wright and

I used two independently, and found that we differed about three or four degrees. This would perhaps not matter for a small area. The needle is extremely sluggish; but we found them useful for route marching with thick snow falling, and one should certainly be taken.

The plane-table is the instrument par excellence. Debenham deserves great credit for taking one south, for Captain Scott was extremely sceptical as to their value on sledge journeys. In open country with a prominent peak (as a referring object) in the line of traverse — conditions such as one always gets in coastal work — the plane-table was extremely rapid and enabled Debenham to do excellent work each day. For details of the geology of a cape or cliff area the plane-table is simply magnificent. In all instruments any metal which must touch bare skin was covered with cloth, etc.

A light theodolite (4 inch) was carried, of course, to tie on to prominent distant peaks and for elevation and base-line measurements. Latitude and longitude and sun azimuths were taken as checks on the triangulation, which later in our journeys was tied on to Mount Erebus.

Cameras. We had large experience with these, Debenham taking Ponting's place when the latter returned. We carried Zeiss and Goerz panorama-stereoscope cameras. They had two great faults for southern work. The rubber focal plane shutters froze stiff, and used to crawl down and then stop half-way, when one wished to give $^1/_{50}$ of a second.

Secondly, they were arranged for glass plates. In spite of advice given me by Mawson and other photographers in the South, I am convinced that a hundred films would give one ten times as many good photos as ten plates, for plates get scratched and broken, and the weight (the only important factor) is the same. When we went a long tramp (side) we always relied on the two film cameras, and they succeeded in producing many splendid photos, while the trouble of changing plates at —20° F. (with your head inside a moulting fur sleeping-bag) can be imagined by any one. For geologists I would recommend the Goerz outfit with front shutters and a film-pack attachment. As it was, my exposures in a very expensive camera of this type (guaranteed to give $^1/_{1500}$ of a second) were made by means of a red cotton handkerchief presented to me by Charles Wright.

For physiographic details, a stereoscopic camera is *sine qua non*; for topographic work a panorama camera is essential; for lantern slides a $\frac{1}{4}$ plate is advisable. The two cameras I have specified fulfill all these conditions, and both have, of course, magnificent lenses.

Yellow light-filters were very necessary, since the blue or white skies, and snow and ice with their blue shadows all had much the same actinic value! The filters cut out the blues light and gave much more contrast in the photographs.

Clothing. No one altered the regulation rig very materially. Upon the head we wore thick 'Balaclava' helmets with ear flaps and throat-protectors. Over them could be worn a burberry (cotton) windproof

helmet. This had a circular opening with a stiffening wire in a flounce, so that one could alter the shape of the flounce and protect the face from a side wind. (Many of us sewed the windproof helmet to the windproof blouse). Very heavy Jaeger woven underpants and singlets were worn next the skin. These we had to wear continuously night and day for months. Over these were worn a thick knitted jersey — and thick corduroy trousers. Above this came a Wolsey Jacket. In blizzards we put on wind-proof trousers tied by lamp-wick at ankles and waist and wind-proof blouse tied at neck and wrists. The writer has fallen through sea ice into the sea and kept quite dry — as regards his body and limbs — in this rig!!

The geologists had to wear the strong corduroy trousers, which were hot for sledging, because the rocks tore wind-proof to pieces. As it was, mine were darned in fifty places with strong twine, and even so were disintegrating when we were picked up. I did not carry my note-books in a case as Wilson preferred, for they slipped easily into the huge pockets on the Wolsey knitted jacket. Aesthetics are perhaps out of place when sledging but some grey or brown colour would have been an improvement on the white of these otherwise excellent jackets. The white jackets soon gave us an even more filthy appearance than necessary, and one sees too much snow and ice to appreciate white clothing. A neutral colour would really have been a welcome object in the view when sledging over the Barrier.

Boots were, however, the one article in which the expedition was weak. We had all sorts of ski-boots

made of fine supple leather, but nothing shod with nails to resist the granite moraines of the western area. Real workmen's Bluchers — size 12 to accomodate four pairs of socks — are advisable. The uppers might be made less stiff; but one's legs are swathed in putties so that matters little. Perhaps professional Alpine boots of the right size might suffice; but plenty of spare spikes and nails should be taken.

Socks. We took spare socks in our personal gear, but on the first journey, owing to bad boots, we were always darning. On the second I reinforced the heels of my other socks with an oval patch of canvas (about three inches long), and I never had to darn a pair.

These trivialities bulk extremely large on a sledging trip, so that I make no apology for mentioning them.

Crampons are illustrated in "Scott's Last Expedition". The canvas tops acted admirably over the fur "finnesko". I should prefer the steel spikes to be even longer, and I should think they might be screwed into the aluminium sole so that new spikes could be inserted. They did not make the feet cold to any marked degree.

For use with the leather boots I liked the 1902 type of Steigeisen. These were strapped under the instep, and enabled me to walk with great ease on slippery glacier ice, though some of the men found they hurt the feet considerably, and so preferred to risk numerous tumbles.

Health. Except for accidents and toothache we had no ill-health, until some of the members succumbed to

scurvy after months of inland sledging. The sledging parties carried a small box of mediums but we had small occasion to use them. A list of drugs, etc., will be found on p. 54 of the "Miscellaneous Data" quoted previously. Snow blindness was relieved by cocaine. We had 3 types of snow-goggles. The slit-in-leather form was not popular. For myself I preferred the amber-colored glasses, but some of my colleagues used the deeper green shade.

In conclusion the writer is sure that application for advice to the new Polar Institute at the University of Cambridge (England) will ensure that the prospective explorer will be fully equipped for his sojourn in the Antarctic.

PRACTICAL HINTS TO SCIENTIFIC TRAVELLERS IN THE WESTERN PART OF VENEZUELA

BY

Jhr. E. A. L. GEVAERTS M. E.
Geologist of the Royal Dutch Oil Company, The Hague

PRACTICAL HINTS TO SCIENTIFIC TRAVELLERS IN THE WESTERN PART OF VENEZUELA

BY

E. A. L. GEVAERTS

CONTENTS

Introduction 145
Climate 146
Population, language, etc. 148
Communication, transport, etc. 150
Clothing, equipment, etc. 151
Hygiene, etc. 152
Insects, etc. 153

INTRODUCTION

As a rule, the time available in a country for actual scientific investigation is limited and the less this time has to be spent in obtaining information on various matters, the greater the chance that the work will turn out to be a success. Therefore, before visiting a country for scientific purposes it will be advisable and even necessary to get acquainted as much as possible with its climate, with the manners and habits of its population, with the living conditions, diseases, methods of communication, etc.

For this purpose the following books may be recommended:

L. V. Dalton, Venezuela, with an extensive bibliography on various scientific subjects (1916).

O. Bürger, Venezuela. Ein Führer durch das Land und seine Wirtschaft (1922).

Dept. of Commerce, U.S.A., Venezuela. A commercial and industrial handbook (1922).

*) W. Sievers, Venezuela. (1888).

*) W. Sievers, Zweite Reise in Venezuela in den Jahren 1892—93.

*) Still useful.

For a map of the country see the various sheets of the millionth series published by the American Geographical Society of New York.

The traveller interested in the geology will find a complete bibliography on this subject in:

A. Jahn, Esbozo de las Formaciones geológicas de Venezuela (Caracas, 1921).

By all means the scientific traveller should first visit Carácas. Here he will meet the Venezuelan scientists, mostly connected with the University, who are able to give invaluable information and most practical advice.

CLIMATE

Venezuela comprises an area of approximately 394.000 square miles (1.020.400 K.M².), about equivalent to Germany and France or Texas and New-Mexico.

Although lying entirely in the tropical zone, the

Camp in dry lowlands, Venezuela.

Crossing a Rio in the beginning of the wet season in the lowlands of Venezuela.

temperature in various parts of the country mainly depends on elevation. Four zones, well marked by different vegetations, may be distinguished:

1°. Tierra caliente or hot zone which extends over all territory below 3000 feet. The average temperature may be taken at between 25—28° C. (77—82° F.), though considerable differences exist;

2°. Tierra templada or temperate zone, comprising the region with an elevation between 3000—6500 feet, showing an average temperature of 17—25° C. (62—77° F.);

3°. Tierra fria or cold zone, including all territory situated between 6500—9000 feet, with a mean temperature of 12—17° C. (54—62° F.).

4°. Los Páramos or treeless zone which extends up to the perpetual snowline, lying at some 15000 feet. The annual temperature shows here 12—0° C. (54—32° F.).

With the exception of the tierra templada, these zones are also recognized by the natives.

As a rule the rainfall is limited to the rainy season which, due to the enormous topographical differences, occur in various regions in different periods of the year. For instance, in the Llanos and in the Guyana Highlands on the whole one wet season occurs lasting from April till December, whereas in the Maracaibo Basin two rainy seasons are recorded; the main one from September–December with heavy showers and a small one from about April–June.

During the main rainy season the lowermost parts of the tierra caliente are inundated, e.g. nearly the

entire Bajo Llanos, whereas the rivers on higher parts of this zone carry so much water that crossing will be as a rule impossible. Since therefore the period of travelling will in general entirely depend on climatological features, it is obvious that the traveller should gather as much information on this subject as possible.

POPULATION, LANGUAGE, ETC.

The population of Venezuela, probably does not exceed three million and mainly consists of a mixture of the Spanish, Indian and Negro elements.

The official language is Spanish with a pronunciation typical for South America. The c and z are pronounced like s, whilst various letters of the lastmentioned syllable are swallowed. With correct Spanish one can always be understood; however, the traveller will soon adopt the above dialect.

Scientific travellers, who intend visiting Venezuela, should obtain a good working knowledge of the language, which will prevent many annoyances. They should be aware, that the Venezuelan people and particularly the better classes are very sensitive to polite and courteous treatment, which cannot be demonstrated too much in the course of conversation. Knowledge of a good vocabulary of compliments and society expressions is of the utmost advantage.

For the same reasons one may get the most out of peons by treating them kindly. However, in some parts of the country, due to their co-operation with foreign negroes and ill-treatment, they have changed

Typical landscape in the dry lowlands round Maracaibo.

Camp for the peons in the jungle. Western part of Venezuela.

considerably. Here it may be added that the peons, and in short, all people, are never addressed otherwise than with "Usted".

Having to work with a gang of peons, the traveller should design one as chief or "corporal" who should know reading and writing, and to whom all orders should be given: a procedure which is highly appreciated by the peons. If possible, the corporal should recruit the gang himself, for the efficiency of which he feels or should be made to feel responsible.

Negroes should be taken neither as "corporal" nor as private servant. Though they may occasionally become very attached to their employer, this quality is fully counterbalanced by greater stupidity and by the considerably smaller influence on the other peons.

As to the rate of wages, variation occurs according to the locality. Around the Maracaibo Lake it is high, due to the enormous demand of the oil-companies. However, in populated regions Bs. 5—6 ($ 1.——$ 1.20) per day, men feeding themselves, and the same amount, with food supply paid for labour in the jungle, may be considered as a fair average.

Often it is necessary to give the peons some money in advance to enable them to buy outfit-utensils as e.g. a mosquito-net, a pair of sandals("alpargatas"), etc.

For completeness' sake it should be mentioned that interpreters are used, when dealing with Indians. Only the Motilones, living in the jungle along the Colombian boundary of the southwestern part of the state of Zulia, are still hostile. When exploring this region, revolvers should be taken along. If not available in a sufficient number to arm each member of the

party, every effort should be made to keep up the peon's spirits which are subject to sudden changes. Dogs might accompany the party, the clearing of the camp should be larger, the party stronger than usual. However, the behaviour of the traveller himself often determines success.

COMMUNICATION, TRANSPORT, ETC.

The railroads and roads are, with a few exceptions, confined to the Andes and Coast Range or to its nearest vicinity, either giving access from the sea or the Maracaibo Lake or connecting up various towns lying in or along these mountain chains. In practice, all travelling will take place on mule or horseback and by river.

As to the former method, one should not have any objection to pay a high price for a good riding animal, since the latter will be appreciated and will give pleasure every day. In making a choice the advice of a reliable expert is desirable; however, when a riding mule has to be bought, one should by all means make sure, that the animal has no special objection to crossing wooden bridges. One should have experienced the trouble, which arises when this is the case, to fully appreciate this advice. At a price of Bs. 1000.——1200, an excellent riding mule may be obtained.

In populated regions the traveller will be able to reach each day a village or ranch in which he will find food and shelter. Therefore he only needs a servant and one pack-mule which carries his spare clothes, hammock, blankets, etc. The servant, who may

be guide at the same time, looks after the animals.

When travelling through, or exploring in uninhabited regions, one needs various packmules to transport the supplies. The "arriero" is in charge of the animals and may be also chief of the transport. Inspect the loads not only before, but also during the trips and do not hesitate to reload an animal, when the packing has not been done properly. Inspect the animals further after each trip and see to it, that mules with sore backs or flanks or any animals attacked by vampire-bats, are treated properly and get lighter loads, or even a rest the next day. The Venezuelan peons as a rule are cruel to animals, but by punishing them severely or even dismissing them on the spot, as soon as orders concerning treatment are broken, they will get careful. Keep always in mind that prevention is better than cure and the transport will run smoothly.

Finally we may add that when no time is available to make a proper road for mule-transport, man-packing is necessary. In this case jute-sacks, which are carried on the back, may be applied successfully.

CLOTHING, EQUIPMENT, ETC.

On account of the high import duties on ready-made clothing of all kinds, including footwear, it is much cheaper to buy superior foreign underwear, collars, ties, shoes, etc., at Trinidad or Curaçao (D. W. I) than in Venezuela itself. Since travellers stay, as a rule, only a short time on these islands, the people are used to making their goods in a couple of days. It should

be noticed, however, that footwear is made in Venezuela cheaply, and that it is good, considering the price. Nails for boots are generally not available and should be taken along. Nailed footwear should be ready to hand when crossing páramos. Since rain, fog and cold winds prevail in this zone, the traveller, who will not be used to such conditions, gets extremely cold, and will try to get warm by walking. The surface of these regions, in general broadly undulating, may often be very slippery on account of the clayish nature of the soil.

The outfit for travelling in cold zones or for mountaineering should be taken along. There are no Venezuelans who know anything of alpinism.

Kodak agencies are met with in various towns and ports.

Arms may *not* be imported; the government is very particular on this point. However, one can procure in the country itself good revolvers, shot guns and cartridges.

The luggage is examined rather carefully; the traveller himself is not searched.

HYGIENE, ETC.

All travellers should be vaccinated against smallpox, typhoid and paratyphoid fever and should take care to avoid being infected by the following common Venezuelan diseases; malaria ("calentura"), dysentery, other intestinal diseases, beri-beri. Venereal disease is very prevalent. Medical treatment has not yet reached European standards; trained nursing atten-

dance is not available in the western part of the country. In Curacao (D. W. I.), excellent medical attention can be obtained.

INSECTS, ETC.

The "tierra caliente" is characterised by its abundance of insects, which form, together with the malaria, the two main annoyances of travellers in Venezuela.

The swampy and humid jungles are inhabited by innumerable mosquitos ("Zancudos"). The traveller, who has to work in them during the wet season, should be prepared to meet with plagues of mosquitos and should carry with him a large mosquito-net, beneath which camp-life will be at least bearable. The bigger it is, the more comfortable one will feel. A net measuring 7 by 10 feet will be quite sufficient. The net should have an edging of plain material, linen or calico, to lie on the ground, when the net is put up. This helps largely to exclude such unwelcome guests as snakes and scorpions.

In the beginning all travellers are annoyed by the "jejenes", so-called "sand flies" which fly during daytime and bite human beings, leaving behind a tiny spot of blood. However, one soon gets acquainted with them. They are as a rule harmless and occur on the plains and in open sunny spots in the jungle.

Much more annoying are the ticks or garrapatas, which mainly are met with in less humid jungles. The larger ones can be felt walking on the skin, and in cases where they have already inserted their heads

into the flesh, they can be pulled off or still better, they may be pinched between the nails, after which they loose easily. The smaller ones, being not bigger than a pin's head, hang on leaves in clusters of even more than 4" diameter. When these clusters are touched by accident, nothing is at first noticed, but suddenly the whole body seems to be covered with these animals, causing terrible itching. Undressing, shaking off the clothes and rubbing off the body, for which a piece of wax is highly recommendable, is the only remedy. Soap containing mercury iodine, may be used successfully.

Once having experienced the above, the traveller will always follow the practice of walking behind one or two natives and not ahead of the party. The natives and particularly real bush-men, observe much more in the jungle than the scientific traveller, even when the latter's brains are not busy with his work. Due to his being totally unprotected to attacks of various poisonous animals, it is for the native a necessity to notice the enemy as soon as possible, and in this respect they have reached a marvellous ability. This quality of the peons is of great use to the traveller, not the least as regards quick observation of snakes, which may occur everywhere in the "tierra caliente", and of nests of wasps, which are pasted against the branches or hang below leaves.

Occasionally travellers in the wet jungle suffer from a hyperdermic worm, called in a general way "gusano", which causes much pain and often provokes fever, sickness and blood-poisoning. These worms will frequently be found in considerable numbers in the abdomens of black flies, which fly during daytime

and resemble common house-flies. These flies are not known to sting, nor does it seem likely, that the small grubs could penetrate a sound skin. Therefore it is possible, that the black flies merely act as a host for these worms, which are introduced into the human body in the form of an egg by some stinging insect, such as mosquitos, etc.

The worm which has a number of short stiff bristles, pierces the skin when full grown, and can then be pressed out. The peons are frequently very adroit at this. The worms grow to a length of not more than 1", with a thickness of abt. $\frac{1}{4}$".

In this connection it may be stated that ticks and "gusanos" cause great suffering to dogs which are taken into the jungle for companionship. Though ticks may be pulled off every day, the infection by the painful worms can hardly be prevented. Disinfecting baths and the application of iodine is the only prophylaxis.

One has to deal in some parts of Venezuela with the chigger. However, the writer has no experience with this troublesome sand flea.

Finally it should be stated that, when wearing boots, one need not fear scorpions, spiders, millepeds, etc., which are all considered poisonous, though not, in cases of normal health, deadly to grown-up people.

HINTS TO TRAVELLERS IN THE REPUBLIC OF HAITI

BY

WENDELL P. WOODRING

Geologist, United States Geological Survey. Washington D. C.

HINTS TO TRAVELLERS IN THE REPUBLIC OF HAITI [1])

BY

WENDELL P. WOODRING

CONTENTS

Introduction 159
General features of the country 160
People 161
Climate 163
Transportation facilities 164
Equipment 166
    Personal equipment 166
    Camp equipment 166
    Equipment for pack and saddle animals . . 167
Subsistence 168
Camp assistance 170
Precautions against disease 170

INTRODUCTION

The following account, prepared at the request of Professor Brouwer, is based on the experience gained in six months of field work in 1920—21, during a

[1]) Published by permission of the Director of the United States Geological Survey.

geological reconnaissance made under a cooperative agreement between the Department of Public Works of the Haitian Government and the United States Geological Survey. The report [1]) giving the results of this reconnaissance fully describes the climate and other physical features of the country. The highways in use when the field work was done and some of the principal trails are shown on the geologic map (scale 1 : 500.000) accompanying the report. This map, though very imperfect, is the latest map of the country.

GENERAL FEATURES OF THE COUNTRY

The Republic of Haiti occupies the western third of the island of Haiti, which is the second largest island in the West Indies. The Dominican Republic occupies the eastern two-thirds. The Republic of Haiti was the French colony of San Domingo until the close of the eighteenth century and the country has a French cultural background. French is the official language and the language of the educated people, but most of the people speak a patois consisting of a French base modified by words taken from other languages. This patois is almost wholly unwritten and devoid of grammar. A traveller who speaks French can easily make himself understood, but he would at first have some difficulty in understanding what is said to him. Some merchants in the cities speak English.

A great part of the country is very mountainous, and a prospective traveller should remember that most

[1]) W. P. Woodring, J. S. Brown, and W. S. Burbank, Geology of the Republic of Haiti: Republic Haiti Geol. Survey, 631 pp., 40 pls., 37 figs., 1924, (English edition); Géologie de la République d'Haïti, 710 pp., 40 pls., 37 figs., 1924 (French edition).

of the time he will be travelling over steep mountain trails. Plains and lowlands of varying size extend along parts of the coast and between the mountain ranges.

Virgin forests have escaped cutting in only the most inaccessible mountains, particularly on the north slope of the Southern Peninsula. At places where cultivation of the soil has been abandoned, the ground is covered with underbrush or guinea grass. There are many extensive natural savannas and thin stands of pine in short grass. In the semiarid regions the vegetation is sparse, consisting principally of cactus and thorny leguminous shrubs and small trees.

Port-au-Prince is the most satisfactory place for headquarters. It is the capital and the most accessible port, and affords good hotel accomodations.

The Dominican Republic was formerly a Spanish colony and the conditions there are different, although the suggestions made regarding camp and pack equipment are probably applicable. Topographic sheets on a scale of 1 : 100,000, with a contour interval of 20 meters, covering about half of the southern part of the Dominican Republic, have been issued by the Secretaria de Fomento y Comunicaciónes in cooperation with the United States Geological Survey. For the remainder of the island see the sheets of the millionth series published by the American Geographical Society of New York.

PEOPLE

The country is rather densely populated. Although no reliable figures are available, there are probably between 1.500.000 and 2.000.000 people living in an

area of about 27.700 square kilometers. As agriculture is the chief industry, the population is essentially rural but is grouped in communities, each of which has a distinctive name. The endless number of place names for groups of even a few houses is likely to confuse the traveller. Most of the population occupies the plains and lowlands, but even the steep mountain slopes are cultivated unless the soil or climate prohibit cultivation.

As in any other country, the inhabitants of rural communities are distrustful of a stranger unless they know his mission. The traveller should be provided with letters from the civil government authorities at Port-au-Prince to the civil officials of the districts that he will visit. He should also have a letter from the chief of the gendarmerie introducing him to the commanders of the gendarmerie posts. A letter from the ecclesiastical authorities will give him access to the homes of the parish priests, who are Frenchmen and will welcome a stranger. They can give the traveller reliable information about the districts in which they live. After the traveller has won the confidence of the people by courtesy and tact, he will find them very kindly and hospitable. If he wishes to lodge at houses instead of establishing camps, he should have no difficulty in finding habitations that are open to him, and the compensation will be left to his discretion. He can stop at any habitation, no matter how primitive, and get a cup of excellent coffee. When he arrives at a destination at the end of a day's travel he may be surprised to learn that he is expected, as news of the movements of a stranger travels in a remarkable manner.

CLIMATE

All parts of the country, except the high mountain ranges, have a moderately warm and rather uniform temperature. The annual mean temperature of 6 stations at or near sea level ranges from 24.6° C. to 27.1° C. At most places where records have been kept the highest monthly mean temperature is in July and the lowest in January or February. At any locality the difference between the highest and lowest monthly mean temperature is small, generally about 5° C. The daily variation of temperature is about 10° C. or a little less. During a period of 8 years the maximum temperature at Port-au-Prince was 37.8° C. and the minimum 15.2° C.

The amount of rain differs greatly from place to place and during different seasons at the same place. The mean annual rainfall at 33 stations ranges from 524 millimeters to 2,659.4 millimeters. Haiti lies in the path of the northeast trade winds and regions in the lee of mountain ranges are semiarid. Although the amount of rain is extremely variable in different parts of the country, the entire country has two well-defined rainy and dry seasons. The rainy seasons are in the spring and fall. The spring rains generally begin in April and last until June, reaching a maximum usually in May. The fall rains begin in August and last until December, and the average maximum is in October and November. The fall rainy season is generally longer than the spring rainy season. The winter dry season is longer than the summer dry season, and the months of December, January, and February are the driest months.

The winter dry season is the best time of the year for travelling, as it combines low rainfall with low temperature. The highways and trails are then in the best condition and overnight camps can be established without shelter. During the rainy season precautions must be taken to keep equipment and specimens from becoming damp and mouldy.

TRANSPORTATION FACILITIES

There are 259.5 kilometers of narrow-gage railroads in the country, operated in several disconnected units. In 1923 a total of 960 kilometers of highways was maintained. Since then other highways have been constructed. Most of these highways can be used by vehicles at any time of the year, but parts are almost or quite impassable during the height of the rainy season. A motor car is essential for extensive travel, but a heavy import duty on cars and gasoline makes motor travel expensive.

Off the highways the traveller is dependent on pack trains. Trails lead from the highways into almost every part of the country. There are probably only a few places in the most rugged mountains where porters would be necessary. Most of the trails are unimproved, but are passable by animals during the dry season. They are not impassable during the rainy season, but at that time travel is slow and difficult.

The time spent on any expedition will depend principally on the choice of pack and riding animals. Burros are the principal burden-bearers of the country, but they should be used only in an emergency. The

horses and mules are small. The horses will not stand long-continued travel and should not be considered. The native mules are the best animals for both saddle and pack. They are very hardy and with proper care can be used day after day. The traveller should not attempt to economize by purchasing inferior animals. A good pack mule costs $ 50 to $ 80 and a gaited saddle mule even more. A fine saddle mule is not necessary, as the explorer is not riding for pleasure. Mules from the southern part of the Dominican Republic are held in high esteem, but good Haitian mules can be had. The traveller will soon learn to supervise personally the care of his animals — to see that they are curried and given sufficient food and water, that enough saddle blankets are used and that the saddles and loads are properly adjusted, and that ears and other parts of the body are kept free of ticks. Special precautions must be taken to guard against sore backs. The saddles should fit properly, and the sweat pads should be frequently washed or discarded. Any slight lesion should be washed with antiseptic solution, as it quickly becomes badly infected. According to the usual practice in Haiti, only the fore feet of the animals are shod.

One or two pack mules are sufficient for each traveller with the simple equipment outlined elsewhere. The man who does the cooking and takes care of the animals can ride on the pack mule that has the lightest load. As the expedition travels specimens that are collected will take the place of food in the packs. By properly arranging the itinerary the specimens can be brought to a highway or port and shipped by motorcar or boat to headquarters, and the party can reoutfit.

The outlying islands can be reached by small sail boats from nearby ports.

EQUIPMENT

PERSONAL EQUIPMENT

Personal equipment for travel in Haiti should be the same as in any moderately warm region and depends principally on personal preferences. Leather puttees or canvas leggins are more suitable than high boots, especially if the traveller will collect specimens along streams. High boots may be preferred in parts of the country where cattle are raised and ticks are likely to be abundant. A flannel shirt is needed for wear during evenings in the mountains and even in some of the lowlands. Slippers or mocassins are a comfort after a day's work. Some travellers and residents in Haiti use tropical helmets, but they are an affectation rather than a necessity. A small duffle bag is very satisfactory for carrying clothing and is easily adjusted to the load on a pack animal.

A leather belt supported by a strap over one shoulder can be used for carrying notebook cases and small instruments. A light poncho should be carried on the saddle.

CAMP EQUIPMENT

It is advisable to reduce camp equipment to a minimum determined by the purpose of the expedition. During the dry season camps can be established with-

out shelter, but a light tent fly should be carried and set up whenever rain threatens to fall. A more substantial shelter is needed during the rainy season. Most explorers have preferences for certain kinds of tents. The most satisfactory tent for a pack train is light in weight, either light canvas or aeroplane cloth, and of medium size. Tents that are entirely enclosed except a small entrance with a mosquito draw bar are very hot. Tent poles can be cut almost anywhere or the tent can be rigged to trees. Folding cots are considered a luxury by some explorers who travel light, but they are worth transporting. If the traveller expects to spend many nights in habitations instead of establishing camps, a hammock can be substituted for a cot. Two blankets in a bed roll of heavy canvas are sufficient except on some of the high mountain ranges. A mosquito sleeping net is indispensable. Aluminum cooking utensils that fit together into compact kits form part of the camp equipment of probably every explorer. Kerosene lanterns are the most satisfactory lighting equipment.

EQUIPMENT FOR PACK AND SADDLE ANIMALS

A great deal of time will be saved if the traveller brings his pack equipment with him. The packsaddles available at almost any market place are crude and unsatisfactory. A standard crosstree packsaddle designed for small animals should be used. It should be equipped with crupper, breeching, breast strap, and double cinches. This equipment may seem elaborate, but it will be appreciated on the steep mountain trails.

Alforjas (pack bags) of heavy canvas should be provided. A waterproof tarpaulin of appropriate size is used in covering the load. Care must be taken to use a sufficient thickness of saddle blankets. Sweat pads of canvas should be used under the blankets. Straw pads that can be purchased almost anywhere can be used under the saddle. If the packs are properly adjusted and lashed, preferably with a diamond hitch, when camp is broken, the pack animals can travel all day without needing any further attention to the load.

A McClellan saddle designed for small animals is probably the best riding saddle for the small animals that are available. The riding saddle should be equipped with crupper and breast strap; otherwise it will not stay in place in travelling over the mountains.

SUBSISTENCE

As the pack train will be climbing over steep mountain trails, the most successful traveller will live off the country as much as possible. The practice of depending on tinned food increases the expense, make the pack train larger, and wastes time. Fresh vegetables and fruits, coffee, bread, eggs, and chickens can be purchased at the market places and at many habitations. Plantains, sweet potatoes, cassava, rice, and beans are the staple foods of the rural districts. Mangos in season are very plentiful, and other fruits and vegetables can be obtained. The market places play a prominent part in the commercial and social life of the rural districts. They may be located in villages or marked only by flimsy booths at places along the trail.

Each market place has a definite name, and the markets are held on certain days. The traveller should inquire about the location of the market places in the region through which he expects to travel, and he should know the days when market is held. The women of the rural districts travel for days to attend these markets, bringing food or other articles for sale or barter. If the traveller happens to miss the market day he may be disappointed in getting supplies of fresh food. The traveller should carry supplies of staple articles, such as flour, sugar, lard, salt, tinned milk, preserves, a small amount of tinned meat, and other articles selected according to his fancy, the amount depending on the density of the population. Wild guinea fowls and wild pigeons are sometimes seen in the Central Plain, but elsewhere there is no game.

Shelled corn, sold by a unit of measure called a *marmite*, usually a small lard can, can be purchased at some of the market places and in the large villages and towns.The traveller will usually not find corn for sale at rural habitations. As corn for his animals is as essential as food for himself, he should inquire about the possibility of purchase and he should carry a supply large enough to last beyond the date of the next probable purchase. It is usually impossible to pasture the animals for the night, and bundles of guinea grass must be purchased at the camping place. Unless camp is pitched in a wholly uninhabited region, visitors will arrive at the camp almost as soon as the traveller, who should immediately make inquiries about grass. A bargain can soon be struck for the delivery of the quantity needed. In the semiarid parts of the country

grass is hard to get, and it may be necessary to send men long distances for a supply. In such regions the traveller should plan to reach camp before dark, or he should, if possible, send a message ahead to have grass delivered.

At some places, especially in the Northwest Peninsula and along parts of the north and south coasts of the Southern Peninsula, itineraries must be planned with reference to the available supply of water. At many places along the coast, where limestone is the surface rock, springs contaminated by sea water are the only source of supply. Unless the water is very salty the animals will drink it and it can be used by the traveller without permanent harmful results, although it is unpalatable.

CAMP ASSISTANCE

Under ordinary conditions a small party will need only one man to cook and take care of the animals. To find a man the traveller should get the assistance of government officials or other prominent citizens of the town where he has established headquarters. A man from a rural district is preferable. An intelligent man will soon learn camp routine and will be very loyal. He will be a successful intermediary in driving bargains for food and forage and in obtaining directions for travel. Except in sparsely inhabited regions guides are not necessary. If they are used they should not be expected to know the country outside of their district.

PRECAUTIONS AGAINST DISEASE

Malaria and dysentery and other intestinal infec-

tions are the principal diseases against which precautions must be taken. A mosquito sleeping net should be used invariably, even where it is thought there is no malaria. If it is known that malaria is prevalent in a region, camps should be made at least a mile from villages. In the mountains the water from streams can be safely used, but in the densely populated lowlands the water should be boiled or treated with chemicals. Uncooked vegetables and unpeeled fruits should be avoided. Occasionally epidemics of a mild form of smallpox break out. Every traveller should take the precaution of having typhoid and para-typhoid inoculations. A simple medical kit containing especially plenty of iodine, quinine,and laxative is indispensable.

Y0-FHR-447